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Ministry of Education and Culture

Research

Report from the Finnish Citation Index Working Group II

Finnish research organizations' publications and citations in the Web of Science, 1990-2009

Reports of the Ministry of Education and Culture, Finland 2012:18

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Ministry of Education and Culture
Department for Education and Science Policy
P.O. Box 29
00023 Government, Finland

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Certain data included herein are derived from the Science Citation Index Expanded, Social Science Citation Index and Arts & Humanities Citation Index, prepared by Thomson Reuters®, Philadelphia, Pennsylvania, USA, © Copyright Thomson Reuters ®, 2011.

Contents

1 Introduction

This report has been prepared by the Citation Index Working Group II, which was appointed by the Finnish National Publication Register project (JURE), a project coordinated by the Finnish Ministry of Education and Culture in cooperation with higher education institutions. The aim of the working group was to examine the development of publishing performance in Finnish research organizations in the past two decades. The report scrutinizes the number of publications and their impact based on data from the Thomson Reuters ISI Web of Science (WoS) database.

The methodological choices in this analysis are based on the work of the Citation Index Working Group I, which examined alternative methods for calculating publishing output and their impact using Thomson Reuters' WoS data for the years 2003-2008.

This study presents an overall picture of the Finnish publication performance in WoS between 1990 and 2009. The analyses are done at the national level as well as by various research organizations and disciplines. Furthermore, the position of Finland in international comparison is explored.

The development of Finnish scientific publishing productivity is explored in a number of publications in four-year blocks of time: 1990-1993, 1994-1997, 1998-2001, 2002-2005 and 2006-2009. The impact of the publications is analyzed by means of citations received by the Finnish publications during the corresponding years (with the exception of the last period, which only covers publications from the years 2006-2008). The Finnish version of this report includes more detailed analyses of all Finnish research organizations (released in 12/2012 http://www.minedu.fi/OPM/Julkaisut/2011/Sitaatioindeksityoryhma_IIn_raportti.html).

Members of the working group

- Olli Poropudas, Ministry of Education and Culture (chair)
- Otto Auranen, Federation of Finnish Learned Societies
- Yrjö Leino, CSC – IT Center for Science
- Maija Miettinen, Academy of Finland
- Reetta Muhonen, University of Tampere
- Anu Nuutinen, Academy of Finland
- Hanna-Mari Puuska, CSC – IT Center for Science
- Janne Pölönen, Federation of Finnish Learned Societies

2 Data and methods

The WoS data has been compiled from three databases provided by Thomson Reuters: the Science Citation Index Expanded, the Social Sciences Citation Index and the Arts & Humanities Citation Index. The data are commonly used in bibliometric research and their pros and cons are well known. The WoS contains high-quality information on all Finnish research organizations' publications and their citations in international scientific journals and it makes it possible to analyse the citation impact of publications as well as make international comparisons. The coverage of WoS varies largely by discipline, country and the year of publication (e.g. Moed, 2005). The data cover publications in the natural and medical sciences most comprehensively, whereas it covers only a small fraction of publications in the humanities and social sciences because publishing activities in these fields are more focused on national publications or books. In engineering, the coverage is moderate.

In this report, a Finnish publication refers to a publication authored by at least one researcher or research group affiliated with a Finnish organization. Finnish research organizations in WoS publications are identified on the basis of the country record field. Research organizations are classified into types of organizations, namely universities, polytechnics, state research institutes, university hospitals and companies[1].

Thomson Reuters applies about 260 subject categories in its classification of journals. All journal issues are classified into 1–6 subjects. In this study, the subject fields assigned to a publication are derived from the journal in which it is published. Thus, each publication is classified into 1–6 fields of science. Moreover, we have grouped the WoS's fields of science into six major disciplines: natural sciences, medicine and health sciences, technology, agricultural sciences, social sciences and humanities (see Appendix 1). In addition, we treat the category 'Multidisciplinary Sciences' in WoS as a single disciplinary group.

WoS publications are categorized into more than 30 different types of publications, of which three have been taken into account in this analysis: articles, letters and reviews. Of all the Finnish publications in the database, these types cover a total of 89 percent.

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1 The current Finnish research system includes 16 universities (13 for science, 3 for arts), 29 polytechnics, and 18 research institutes financed by the state. The health care system consists of 20 hospital districts, including five university hospitals and plenty of other hospitals and units of health care.

2.1 Publication indicators

In our analysis of publishing productivity, we apply both whole counting and fractionalized counting to the publications. The whole publication count has to do with the total number of such publications that at least one author with a Finnish address has contributed to. In fractionalized counting, the credit for a publication is divided both with respect to the contributing organizations and with respect to the disciplines. The internationally co-authored publications are first divided equally among all participating countries irrespective of how many organizations in each country have contributed to them, and the Finnish share is further divided equally between the various Finnish organizations. Additionally, for the analyses specific to particular disciplines (or types of research organizations, respectively), if a publication belongs to several disciplines (or types of research organizations), then it is divided equally between all of them.

We used the relative specialization index (RSI) to measure Finland's publishing activity in various disciplines relative to the world average[2]. The RSI ranges between [-1,1) and the value of 1 is never reached. An RSI value of 0 indicates that the share of the publications belonging to a particular discipline is equal to the corresponding share of WoS publications for the whole world. A negative value means that the share is smaller than that of the rest of the world. In turn, a positive value refers to a higher share than in the entire world.

2.2 Citation indicators

In this report, the impact of Finnish publications is measured using relative citation indices. As the fields of science differ in terms of their citation practices, the number of citations for each publication is normalized by comparing the number to the average number of citations received by all publications in the whole world. In the field normalized citation index, the citation rates are compared to publications in the rest of the world that are in the same subject field, of the same publication type and published in the same year. In addition to field normalization, we also calculated the journal normalized citation index using a similar method, but instead of comparing citation rates to the field average, we normalized the number of citations received by a publication to the number of publications published in the same journal.

As another indicator of the impact of publications, we calculated the Top-10 index. The Top-10 index describes the proportion of Finnish publications positioned in the top ten per cent of the world's most cited publications[3]. As with the relative citation index, the Top-10 index is also normalized with respect to the world publications in the same subject field, the same publication type and the same publishing year. Values for both the relative citation index and the Top-10 index that are greater than 1 refer to a stronger impact relative to the whole world. Respectively, values less than 1 refer to a lower impact compared to the world average.

Since the publications published in 2009 have not yet been cited often enough, the citation indices are presented only for publications that have been published before 2009. In the citation analyses, the citation window is not limited, i.e. we consider all citations received during the entire period 1990-2009. The number of citations received by a publication is always fractionalized in exactly the same way as the publication itself is fractionalized between organizations and subject categories.

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2 The relative specialization index (RSI) is calculated on the basis of the activity index (AI), which is defined as

$$AI = \frac{\text{the share of the particular discipline in the Finnish publications}}{\text{the share of the particular discipline in the world's publications}}$$

Then, RSI is defined as $RSI = \frac{AI-1}{AI+1}$.

(See, NordForsk 2010, REIST-2 1997)

3 The proportion of publications belonging to the list of the world's most often cited publications is not necessarily exactly 10%. Therefore, the index describes the proportion of Finnish publications belonging to this percentile relative to the proportion for the world.

3 The development of Finnish publication productivity and citation impact

The WoS data includes 143,000 publications in the years 1990–2009 contributed by at least one Finnish organization (whole publication count). The fractionalized publication count for the same 20-year period is 109,000. The whole count of Finnish publications has more than doubled from 1990–1993 to 2006–2009 (Figs. 3.1 and 3.2). The fractionalized counts increased by 76% from 1990-1993 to 2006-2009. The lower growth rate in the fractionalized counts compared to the whole counts indicates that co-publishing with foreign organizations has increased over the past two decades.

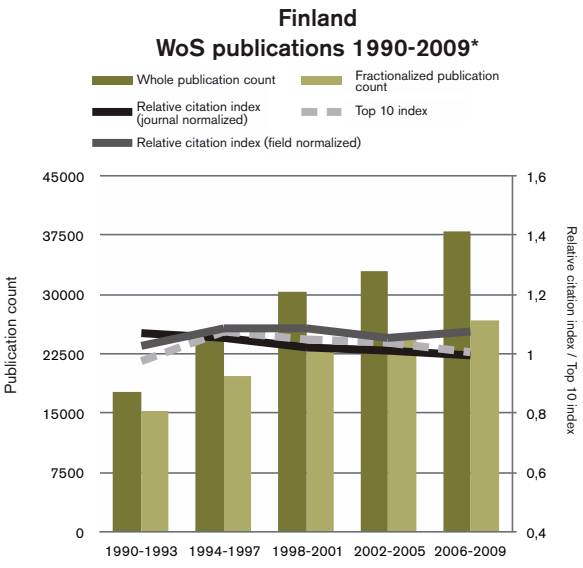


Figure 3.1 Number of Finnish WoS publications in 1990-2009 and their citation impact in 1990–2008

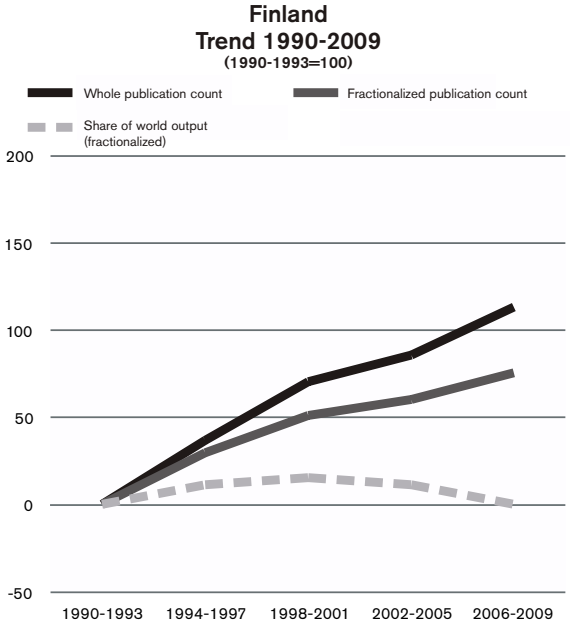


Figure 3.2 Indexed development of Finnish WoS publication counts in 1990-2009

Finland's share of the world's publications has varied from 0.68 to 0.89 per cent, and the fractionalized publication counts accounted for 0.58–0.68 per cent of the world output in the years 1990-2009. In ei-ther way of counting, the number of Finnish publications has grown slightly faster than the number of publications throughout the world up to the years 1998-2001, when Finland's share of world publica-tions was at its highest (Fig. 3.2). Thereafter, Finland's share of the fractionalized number of publication out of the world's publication count decreased. This can be explained, for example, by an increasing number of co-authored international publications as well as by extensive growth in the publishing rates in, for example, China and India.

Finland's field normalized citation index remained above the world average throughout the whole peri-od of 1990-2008 (Fig. 3.1). It was at its highest (1.09) in the years 1994-2001, after which it fell during the period 2002-2005 (1.05). However, it rose slightly again between the years 2006 and 2008 (1.07). Except for the years 1990-1993, the journal normalized citation index has been lower than the field based index. This suggests that Finnish authors have published a great deal in those journals that receive more citations than the journals in the same subject area on average.

Figure 3.3 shows the development of Finnish publication productivity and impact specifically for the years 2002-2008. The number of publications has grown steadily year to year. The field normalized cita-tion index shows a downward trend from the early 2000s, with the low point occurring in the year 2005. In 2006-2008, the decline is, however, defeated. As a consequence, the citation index in 2008 is roughly at the same level as in 2002.

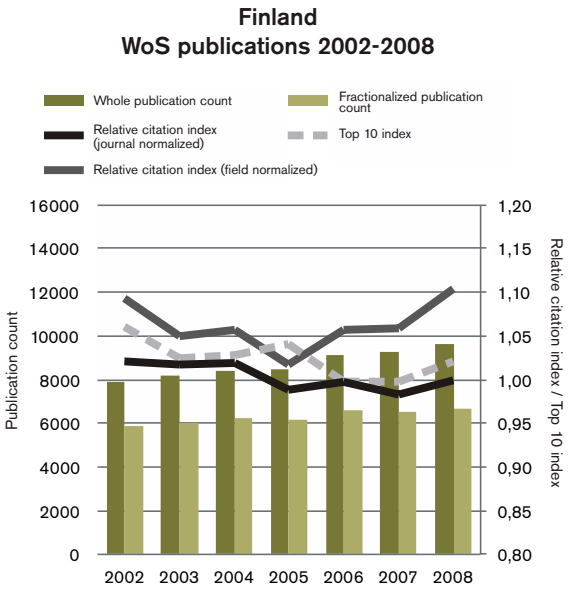


Figure 3.3 Number of Finnish WoS publications and their citation impact in 2002–2008, with overlapping four-year periods

4 Publishing productivity and citation impact in different types of research organizations

The whole publication count for Finnish universities in the entire two-decade period is approximately 107,000, which accounts for roughly 75 per cent of the total Finnish output (Table 4.1). Both university hospitals and state research institutes have contributed a total of approximately one-fifth of Finnish WoS publications. Companies account for six per cent of the total, and other health care units account for four per cent of the total. The scientific publishing activity of polytechnics is very low; they constitute only 0.4 per cent of Finnish publications. 15 percent of publications are authored by scholars from other organizations, such as municipal institutions, the Finnish defence forces, police authorities, government agencies, labour organizations and national health care associations.

When measured using the fractionalized publication count, the universities account for approximately 60 per cent of the total Finnish output (Table 4.1). University hospitals account for 14 per cent of total Finnish fractionalized counts and other health sector units account for less than two per cent of the total Finnish fractionalized counts. State research institutes account for 13 per cent and companies for four per cent of the total Finnish fractionalized counts. The publishing activity of polytechnics is very low, yielding only 0.2 per cent of Finnish publications in WoS.

The shares of the whole publication count have grown for most types of research organizations, while their shares of the fractionalized count have remained quite stable throughout the two decades. This indicates an increase in the number of collaborative publications between different types of organizations. The university hospitals and companies have experienced a decrease in their share of fractionalized publication counts. Moreover, their share of the whole publication count has decreased, which suggests that their publishing productivity has not grown as fast as in other types of research organizations (Table 4.1).

Table 4.1 Share of Finnish publications from different types of research organizations

Share of Finnish publications (whole counts*)	1990–1993	1994–1997	1998–2001	2002–2005	2006–2009	Total 1990–2009
Universities	69%	71%	75%	77%	78%	75%
State research institutes	15%	17%	18%	20%	21%	19%
University hospitals	20%	21%	24%	23%	21%	22%
Other health care units	2.7%	2.1%	3.0%	4.5%	5.4%	3.8%
Companies	6.5%	5.8%	6.0%	6.3%	5.9%	6.1%
Polytechnics	0.0%	0.1%	0.3%	0.6%	0.7%	0.4%

Share of Finnish publications (fractionalized counts**)	1990–1993	1994–1997	1998–2001	2002–2005	2006–2009	Total 1990–2009
Universities	59%	61%	58%	60%	61%	60%
State research institutes	12%	13%	13%	13%	13%	13%
University hospitals	16%	15%	15%	13%	12%	14%
Other health care units	1.8%	1.1%	1.4%	1.9%	2.1%	1.7%
Companies	4.6%	3.8%	3.8%	3.8%	3.5%	3.8%
Polytechnics	0.0%	0.1%	0.2%	0.3%	0.4%	0.2%
Other	7%	6%	9%	9%	9%	8%

*) In whole counting, a publication co-authored by several types of research organizations is counted as a whole publication for each participating organization type. Thus, the percentages do not add up to 100 percent.

**) In fractionalized counting, a publication co-authored by several types of research organizations is fractionalized by organiza-tion types. Thus, the percentages add up to 100 percent.

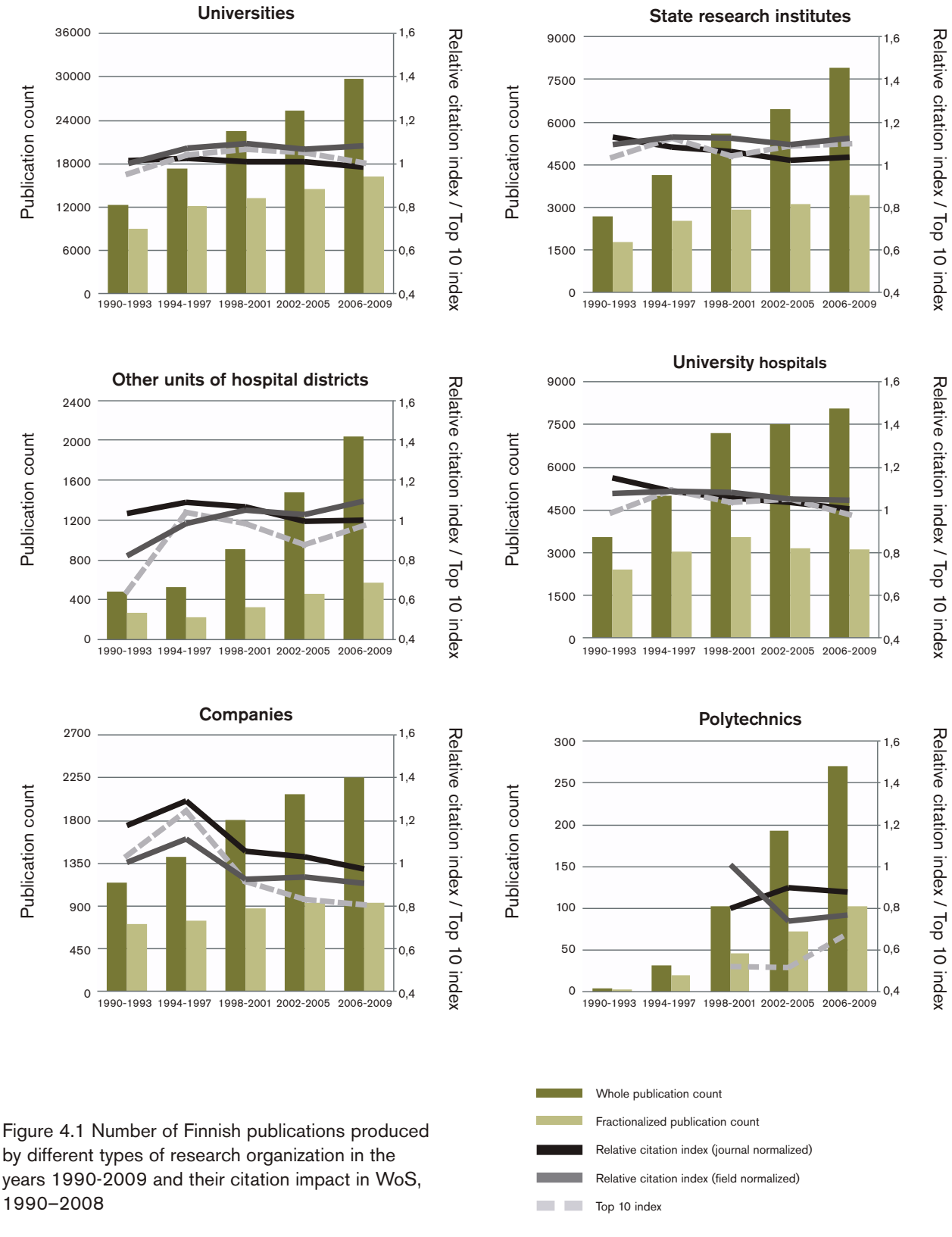


Figure 4.1 Number of Finnish publications produced by different types of research organization in the years 1990-2009 and their citation impact in WoS, 1990–2008

The number of publications has increased rapidly among state research institutes. The whole publication count increased threefold between the years 1990-1993 and 2006-2009 (Fig 4.1). Universities contributed 2.4 times more publications in the years 2006-2009 than in the years 1990-1993. The fractionalized publication counts have also increased, although more moderately: they have doubled for state research institutes and increased 1.8-fold in universities.

In university hospitals, the whole counts have increased 1.5-fold between the years 1990–1993 and 2006–2009. In contrast, the fractionalized publication count did not increase notably from the early 1990s, but has actually fallen since 1998-2001. This is due to the fact that, especially in the medical sciences, co-publishing between organizations has increased. This is also the case for companies, where the whole count has increased approximately two-fold between the years 1990-1993 and 2006-2009 but the fractionalized count did not increase significantly.

The other health care units and polytechnics constitute only a minor part of Finnish publications, but at the same time they have experienced in relative terms the fastest growth in publication counts among all types of research organizations. For health care units, the whole publication count has increased fourfold, whereas the fractionalized count slightly more than doubled. Polytechnics contributed only four publications in the years 1990-1993, while the respective count was 270 in the years 2006-2009.

The state research organizations are superior to the other types of organizations when measured using the field normalized citation index. Also, universities, university hospitals and other health sector units exceed the world average citation rate. This is also the case when the impact of publications is measured using the Top-10 index. The citation indices have not changed remarkably for any types of research organizations except for companies, where they have fallen since 1994-1997.

5 Publishing productivity and citation impact in different disciplines

Of all Finnish publications (whole counts), 43 per cent were published in journals assigned to the natural sciences and 38 per cent in medical and health science journals (Table 5.1). Engineering has accounted for approximately ten per cent of publications. The proportion of publications from medicine and the health sciences has decreased by 12 percentage points between the years 1990-1993 and 2006–2009, while the proportion of publications in the natural sciences has increased by five percentage points. Likewise, publications in the social sciences and engineering have increased in relative terms.

The fractionalization of publications reduces the proportion of publications for the natural sciences, while other disciplines' share of the fractionalized publication counts is slightly higher than with the whole counts. This is due to the fact that there are more internationally co-authored articles in the natural science journals than there are for the other disciplines.

The share of world publications in Table 5.1 indicates that the number of publications in the journals for the social sciences, humanities, medicine and health sciences, as well as multidisciplinary sciences, have grown relatively more rapidly than in rest of the world, whereas publishing in engineering has not increased as quickly as the total number of WoS publications in the world.

Table 5.1 Share of Finnish publications in journals from different disciplines

Share of Finnish publications (whole counts)	1990–1993	1994–1997	1998–2001	2002–2005	2006–2009	Total 1990–2009
Natural sciences	39%	41%	43%	45%	44%	43%
Medicine and health sciences	45%	42%	39%	35%	33%	38%
Engineering	7%	7%	8%	9%	9%	8%
Agricultural sciences and forestry	4%	4%	4%	4%	4%	4%
Social sciences	4%	4%	5%	5%	7%	5%
Humanities	1.1%	0.8%	1.0%	0.9%	1.3%	1.0%
Multidisciplinary sciences	0.7%	0.7%	0.7%	0.5%	0.7%	0.6%

Share of Finnish publications (fractionalized counts**)	1990–1993	1994–1997	1998–2001	2002–2005	2006–2009	Total 1990–2009
Natural sciences	36%	38%	39%	42%	41%	40%
Medicine and health sciences	47%	44%	41%	36%	34%	39%
Engineering	7%	8%	9%	10%	11%	9%
Agricultural sciences and forestry	5%	4%	5%	5%	5%	5%
Social sciences	4%	5%	5%	6%	8%	6%
Humanities	1.3%	0.9%	1.2%	1.2%	1.7%	1.3%
Multidisciplinary sciences	0.6%	0.5%	0.5%	0.4%	0.5%	0.5%

Share of world publications (fractionalized counts**)	1990–1993	1994–1997	1998–2001	2002–2005	2006–2009	Total 1990–2009
Finland in total	0.59%	0.65%	0.68%	0.65%	0.59%	0.63%
Natural sciences	0.50%	0.57%	0.61%	0.61%	0.55%	0.57%
Medicine and health sciences	0.43%	0.47%	0.54%	0.59%	0.53%	0.52%
Engineering	0.89%	0.96%	0.91%	0.78%	0.65%	0.82%
Agricultural sciences and forestry	0.77%	0.82%	0.93%	0.93%	0.79%	0.85%
Social sciences	0.31%	0.44%	0.54%	0.61%	0.68%	0.53%
Humanities	0.16%	0.14%	0.21%	0.23%	0.33%	0.22%
Multidisciplinary sciences	0.15%	0.19%	0.25%	0.20%	0.28%	0.21%

*) Publications are not fractionalized by countries, but they are fractionalized equally by disciplines in cases where the journal subject fields belong to more than one discipline.

**) Publications are fractionalized both by countries and by disciplines.

The agricultural sciences and forestry account for a slightly higher proportion of Finnish publications than the total world publication output for the years 2006–2009 (Figure 4.1). Meanwhile, the shares for the medical sciences and the natural and the social sciences, as well as engineering, correspond to their respective shares for the whole world. Publications in humanities and multidisciplinary journals are less typical for Finland relative to the entire world.

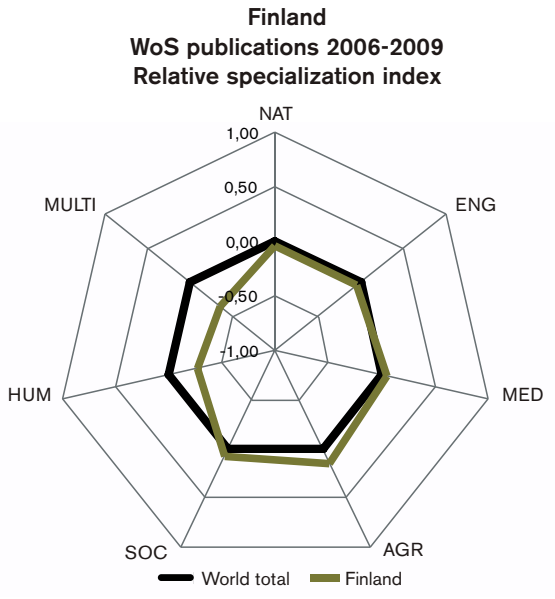


Figure 4.1 Share of Finnish publications from different disciplines relative to their share of world publications (the relative specialization index) in 2006–2009

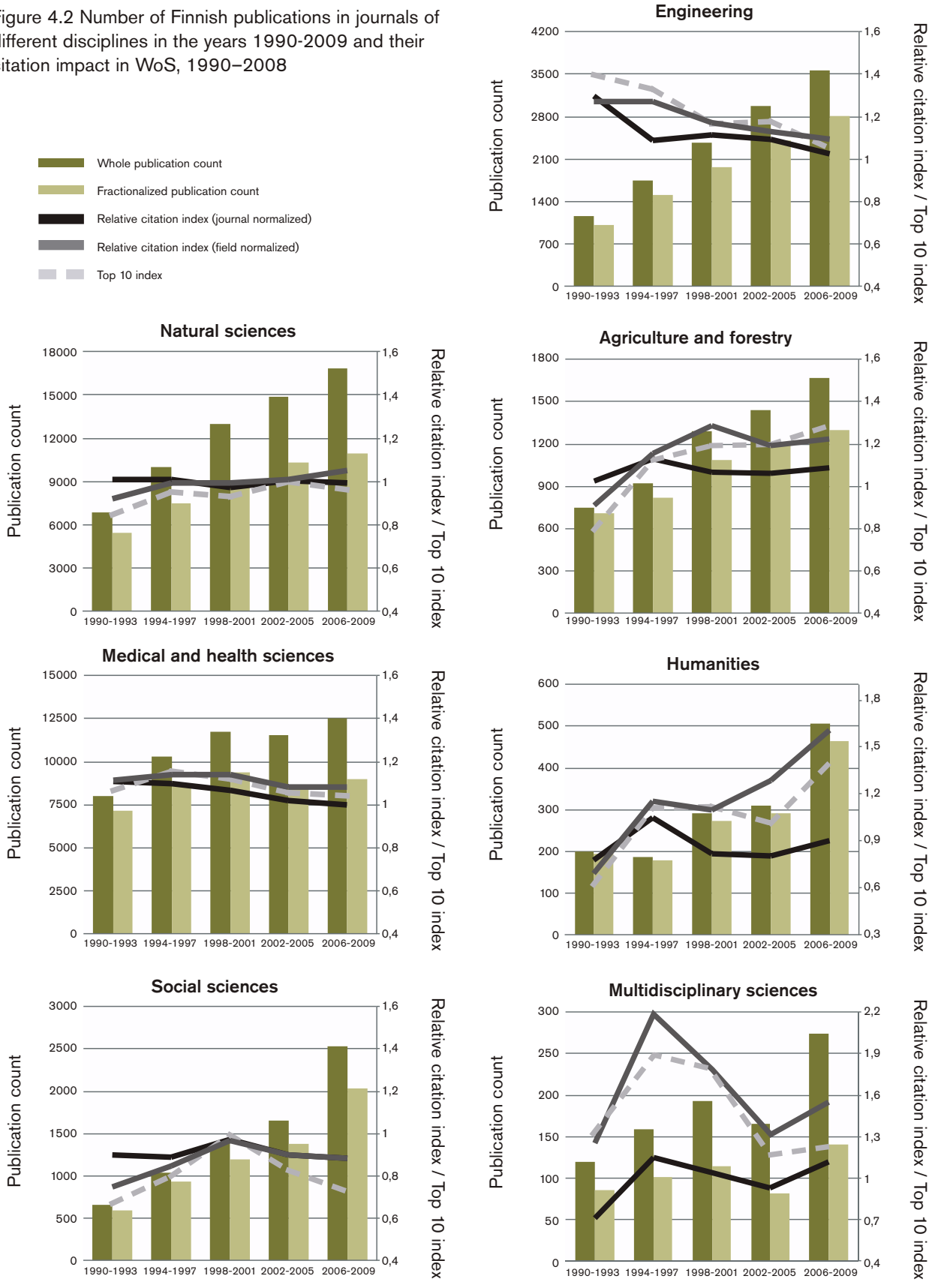
The number of Finnish publications has increased quite steadily in all disciplines. The publishing output in engineering has, however, grown significantly faster than the output for other disciplines in Finland: the whole publication count has increased by more than three times between the years 1990-1993 and 2006–2009 (Fig. 4.2). This is due to the overall improved coverage of engineering journals by Thomson Reuters: Table 3.1 displays, however, a lower growth rate for engineering publications in Finland compared to the rest of the world.

The natural sciences, social sciences and humanities have also experienced a relatively more rapid increase in whole publication counts than the Finnish national average: the whole counts increased 2.5-fold between the years 1990-1993 and 2006–2009. Meanwhile, the increase has progressed rapidly in other disciplines as well during the two decades; in social sciences and the humanities the most remarkable growth has taken place during the last two four-year periods: from 2002-2005 to 2006-2009.

The growth rate in multidisciplinary journals and in agricultural sciences and forestry was close to the Finnish average, where the number of publications slightly more than doubled. The lowest relative increase occurred in medicine and the health sciences, where the number of publications increased 1.6-fold.

The fractionalized publication counts have increased clearly less than the whole counts in all disciplines except for the humanities, where the trend is nearly identical for both publication counting methods. The difference between fractionalized and whole counts has broadened especially in medicine and the health sciences as well as in the natural sciences during the 20-year period under study. This indicates that the degree of international co-authored publications has increased in these disciplines.

Figure 4.2 Number of Finnish publications in journals of different disciplines in the years 1990-2009 and their citation impact in WoS, 1990–2008



From the beginning of the 1990s, the highest growth in the field normalized citation index has occurred in the humanities (albeit the publication counts are very small), the agricultural sciences and forestry and the natural sciences. In medicine and the health sciences, as well as in engineering, a clear decrease in the citation rates appears compared to the world level. In all disciplines, the Top-10 index has fol-lowed a similar trend as the relative citation index.

From the mid-1990s, the journal normalized citation index has remained below the field based index in all disciplines. That is, the Finnish authors have published in journals that are cited more often on aver-age than the other journals in a particular subject field. The social sciences constitute an exception in that sense, since both their citation indices are at about the same level.

The citation indices for the different disciplines should not be compared across disciplines due to the biased coverage of publications in certain disciplines, namely in the social sciences and humanities. The field normalized citation index in multidisciplinary journals clearly exceeds the world level, which should be obvious because they include two of the world's most cited journals, Nature and Science.

6 Publications and citation impact in the largest research organizations

Research organization	Number of publications (fractionalized count) 2006-2009	Field-normalized relative citation index 2006-2008	Top-10 index 2006-2008
1. National Institute for Health and Welfare (THL)	780	1.35	1.37
2. Agrifood Research Finland (MTT)	291	1.25	1.16
3. University of Helsinki (HY)	4,670	1.19	1.09
4. Technical Research Centre of Finland (VTT)	663	1.17	1.20
5. Åbo Akademi University (ÅA)	822	1.13	1.09
6. University of Jyväskylä (JY)	1,293	1.12	1.09
7. Helsinki University Central Hospital (HYKS)	1,458	1.12	1.14
8. Aalto University	2,279	1.10	1.05
9. Kuopio University Hospital (KYS)	466	1.05	0.94
10. Turku University Central Hospital (TYKS)	358	1.05	0.97
11. The Finnish Forest Research Institute (METLA)	405	1.05	0.94
12. University of Eastern Finland (ISY)	1,675	1.04	0.95
13. University of Tampere (TaY)	834	0.98	0.87
14. University of Oulu (OY)	1,602	0.97	0.85
15. University of Turku (TY)	1,661	0.96	0.91
16. Tampere University Hospital (TAYS)	494	0.92	0.71
17. Tampere University of Technology (TTY)	778	0.92	0.89
18. Institute of Occupational Health (TTL)	336	0.91	0.91
19. Lappeenranta University of Technology (LTY)	330	0.87	0.81
20. Oulu University Hospital (OYS)	334	0.85	0.68

Table 6.1 The 20 most productive Finnish research organizations in the years 2006-2009 ranked by the field normalized citation index for 2006-2008

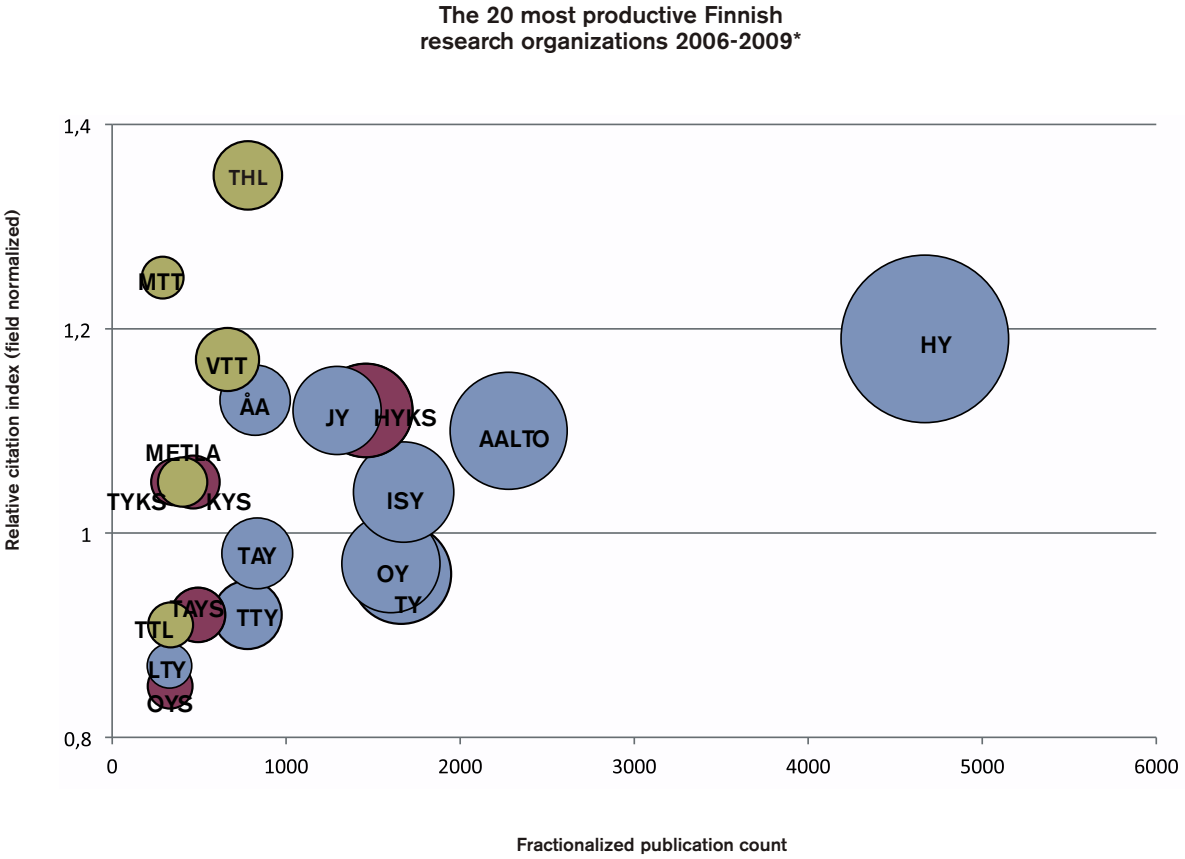


Figure 6.1 Number of publications in the years 2006-2009 and field normalized citation index in 2006-2008 in the 20 most productive Finnish research organizations in terms of publication counts

The 20 most productive Finnish research organizations in terms of WoS publications in the years 2006-2009 include ten universities, five state research institutes and five university hospitals (Table 2.4 and Figure 6.1). Among these 20 organizations, the field normalized citation index for publications in 2006-2008 is the highest for the National Institute for Health and Welfare (THL), Agrifood Research Finland (MTT) and the University of Helsinki (UH). When measured using the Top-10 index, THL still holds the top position while the VTT Technical Research Centre of Finland has the second highest share of publications in the world's most cited 10 per cent. MTT has the third highest impact when measured using the Top-10 index.

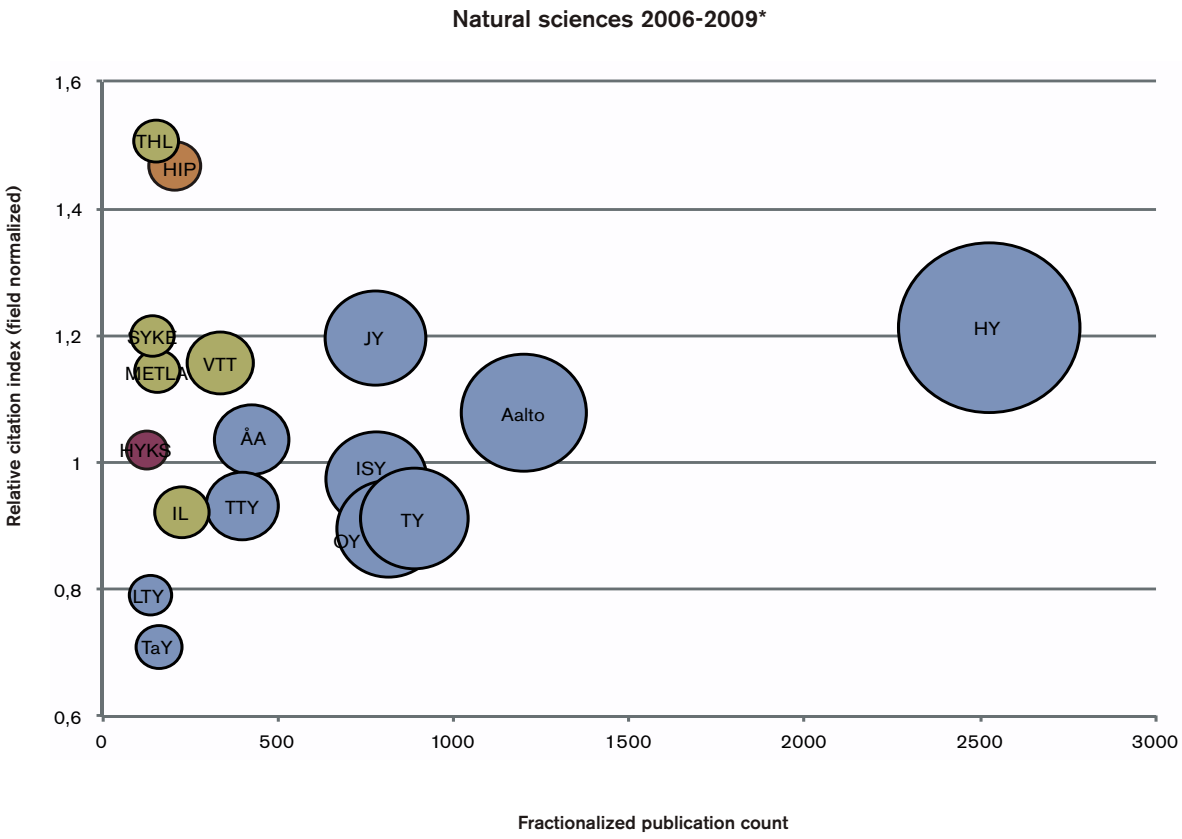


Figure 6.2 Natural sciences: number of publications in the years 2006-2009 and field normalized citation index in 2006-2008 in research organizations where the proportion of the Finnish fractionalized publication count is more than 1%

In the years 2006-2009, the majority of Finnish publications in natural science journals were authored by university researchers (75% of fractionalized counts, see Appendix 2, Table 2.2). State research institutes produced 14 per cent of publications in the natural sciences.

A significant proportion of Finnish publications in the natural sciences (24% of the fractionalized counts) were authored by University of Helsinki researchers (HY; Fig. 6.2). Aalto University is the next most productive publisher in the natural sciences (11%). The National Institute for Health and Welfare (THL) and the Helsinki Institute of Physics (HIP) have had the greatest impact on the numbers: their natural science publications in the years 2006-2008 received about one and a half time as many citations on average as the corresponding fields for the whole world.

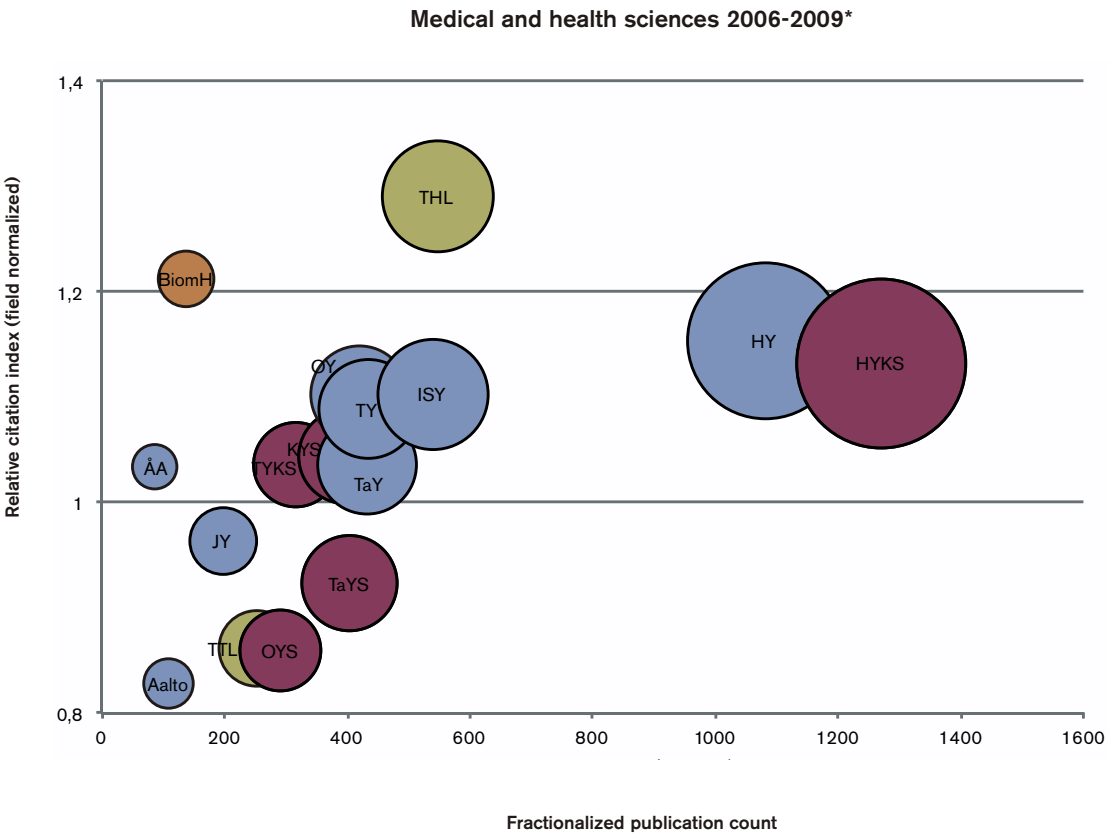


Figure 6.3 Medicine and health sciences: number of publications in the years 2006-2009 and field normalized citation index in 2006-2008 in research organizations where the proportion of the Finnish fractionalized publication count is more than 1%

In 2006-2009, 37 per cent of Finnish fractionalized publication counts for medicine and the health sciences were attributed to universities and 30 per cent to university hospitals. The corresponding proportion for state research institutes was 10 per cent (Appendix 2, Table 2.3).

The University of Helsinki (HY) and Helsinki University Central Hospital (HYKS) are clearly the most productive in terms of publishing output in medical and health science journals (Fig. 6.3). When the fractionalized counts for the universities and university hospitals are added together, the shares by region in the years 2006-2009 were as follows: Helsinki 26%, Eastern Finland 10%, Tampere 9%, Turku 8% and Oulu 8%.

For medicine and the health sciences in the years 2006-2008, the National Institute for Health and Welfare (THL) had the highest relative citation index: its publications received 29 per cent more citations than the world average. Biomedicum Helsinki (Biom H) had the second highest relative citation impact: 1.21.

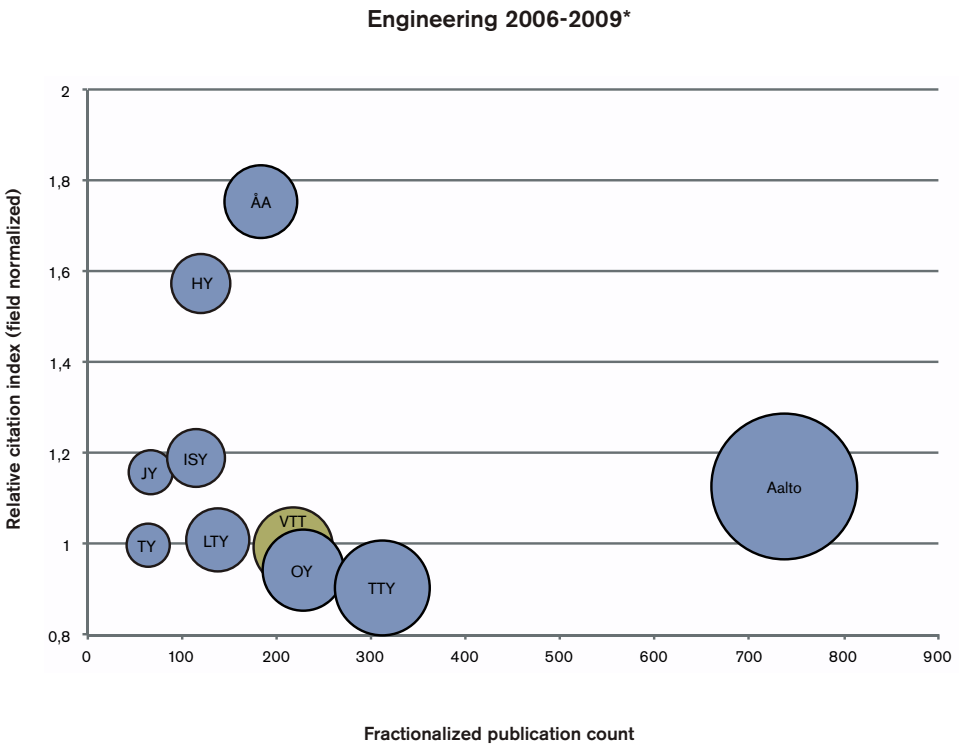


Figure 6.4 Engineering: number of publications in the years 2006-2009 and field normalized citation index in 2006-2008 in research organizations where the proportion of the Finnish fractionalized publication count is more than 1%

For engineering journals in the years 2006-2009, the universities' share of fractionalized counts of Finnish publications is 71 per cent. State research institutes and companies each comprise approximately 11 per cent of the Finnish count (Appendix 2, table 2.4).

With a 26 per cent share, Aalto University accounted for the greatest number of engineering publications in the years 2006-2009 (Fig. 6.4). Tampere University of Technology (TTY) had the second largest proportion of publications in engineering: 11%.

Åbo Akademi University had the highest relative citation index for engineering publications in the years 2006-2008: it received 71 per cent more citations than the world average. Also, the University of Helsinki (HY) had a high relative citation impact in engineering: 1.57.

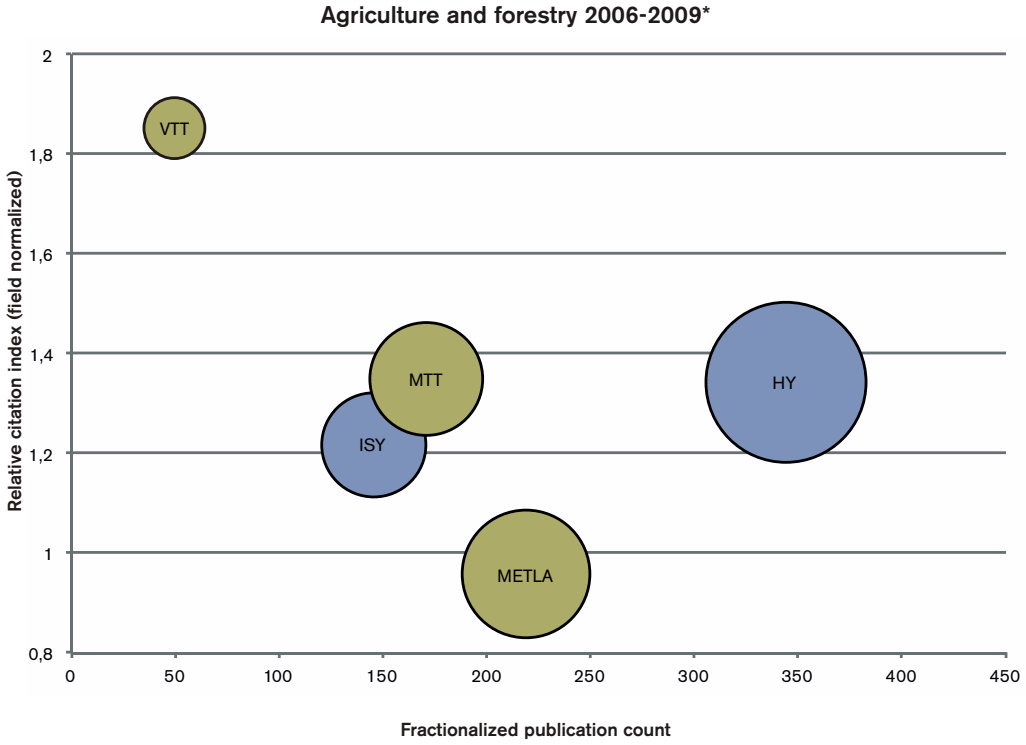


Figure 6.5 Agricultural sciences and forestry: number of publications in the years 2006-2009 and field normalized citation index in 2006-2008 in research organizations where the proportion of the Finnish fractionalized publication count is more than 1%

The shares of publications in the agricultural sciences and forestry authored by researchers at universities and state research institutes are almost equal: 47 and 41 percent, respectively (see Appendix 2, table 2.5).

The University of Helsinki was the most active Finnish organization in terms of publishing in the agricul-tural sciences and forestry in the years 2006-2009; it accounted for 27% of the Finnish fractionalized publication count (Fig. 6.5). The next highest number of publications was produced by the Finnish Forest Research Institute (METLA; 17%), the Agrifood Research Institute (MTT; 13%) and the University of Eastern Finland (11%).

On average, the largest amount of citations for the publications in the years 2006-2008 were collected by VTT, which received up to 85 per cent more citations than the world average. However, VTT's overall number of publications in the agricultural sciences and forestry is very low. The University of Helsinki and MTT also have relatively high citation indices: more than a third above the world average.

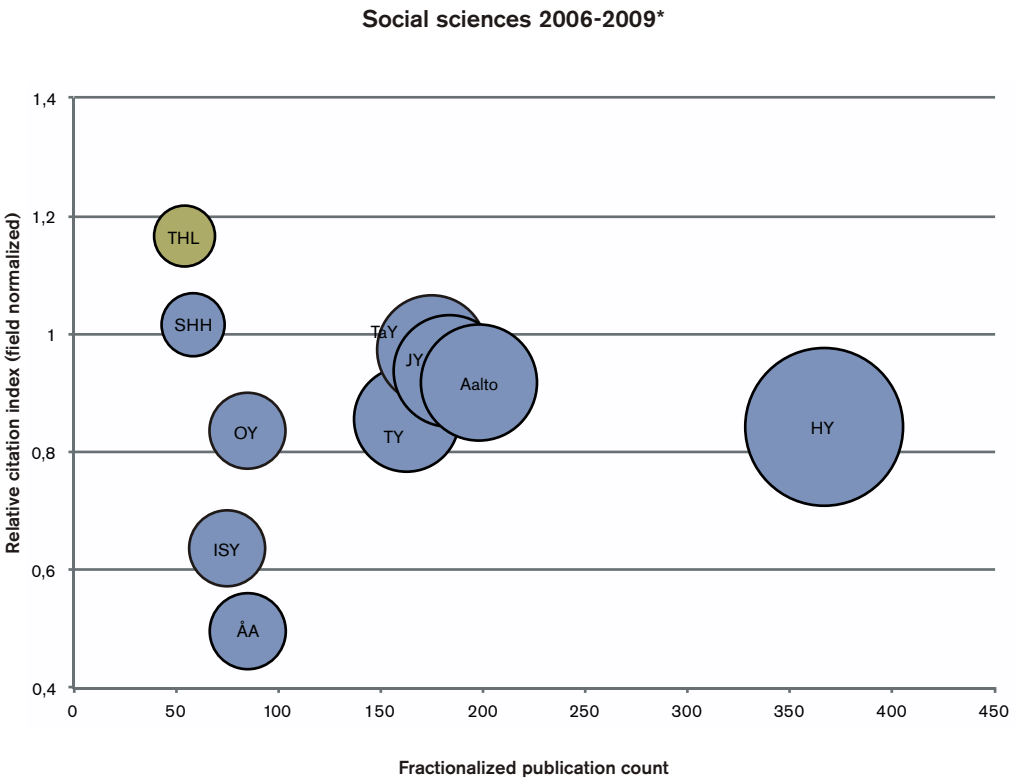


Figure 6.6 Social sciences: number of publications in the years 2006-2009 and field normalized citation index in 2006-2008 in research organizations where the proportion of the Finnish fractionalized publication count is more than 1%

Finnish publications in the social sciences in the years 2006-2009 were mainly produced by universities (73 per cent of fractionalized counts). State research institutes account for 8 per cent and university hospitals 4 per cent of publications (See Appendix 2, table 2.6).

The University of Helsinki's share of social science publications is 18 per cent, while the proportions for all other organizations were less than ten per cent (Fig. 6.6). The National Institute for Health and Welfare had the highest relative citation index: 1.16. Other organizations whose fractionalized publication count in the social sciences in the years 2006-2009 was at least 50 received an equal number or fewer citations than the world average.

For the humanities, the great majority of Finnish publications in the years 2006-2009 (87%) were authored by university researchers. With a 38 per cent share of Finland's fractionalized count, the University of Helsinki is by far the most productive university for publications in the humanities.

Of Finnish publications in multidisciplinary journals in the years 2006-2009, 75 per cent were authored by university researchers, nine per cent by state research institutes and six per cent by university hospitals. The University of Helsinki accounted for 41 per cent of these publications.

7 Finnish publishing performance in international comparison

Finland produced more WoS publications per capita than any other OECD or BRIC country (Brazil, Russia, India and China) in terms of fractionalized publication counts during the period 2006-2009 (Fig. 7.1). Per million inhabitants, 1,259 fractionalized publications a year were drawn up in Finland. Switzerland and Sweden had the next highest publication rates. All of the Nordic countries were found among the 11 most productive OECD countries. Out of whole publication counts in OECD and BRIC countries in the years 2006-2009, 28 per cent were published by authors in the United States, nine per cent by authors in China, seven per cent by authors both in Great Britain and Japan and six per cent by authors in Germany. Other countries' shares of the publication counts ranged from less than one per cent to four per cent. Finland's share was about one per cent.

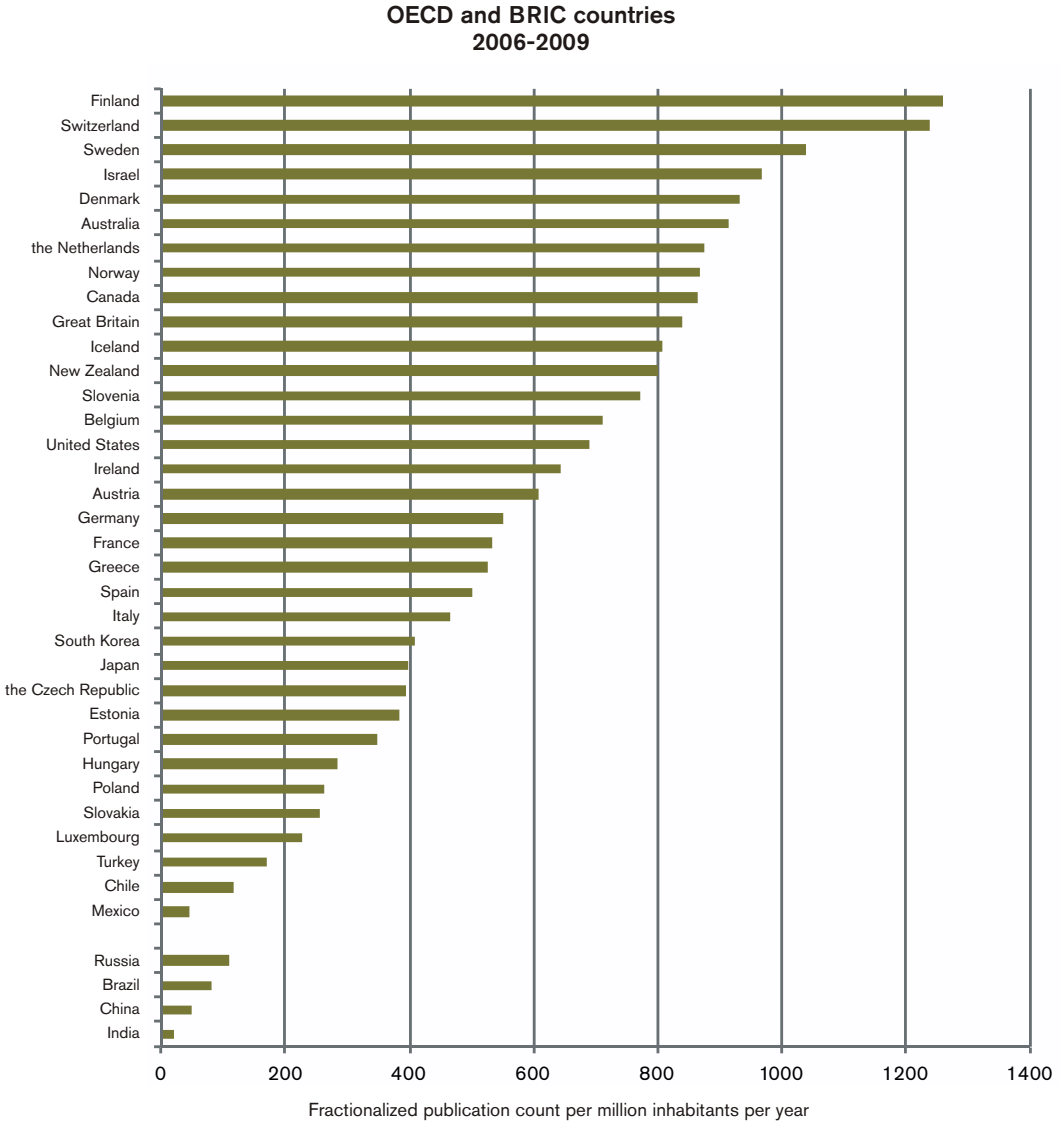


Figure 7.1 Fractionalized publication counts per million inhabitants for OECD and BRIC countries in the years 2006–2009

Note. Number of publications and inhabitants in 2006–2009. Data on inhabitants: OECD Factbook (2010).

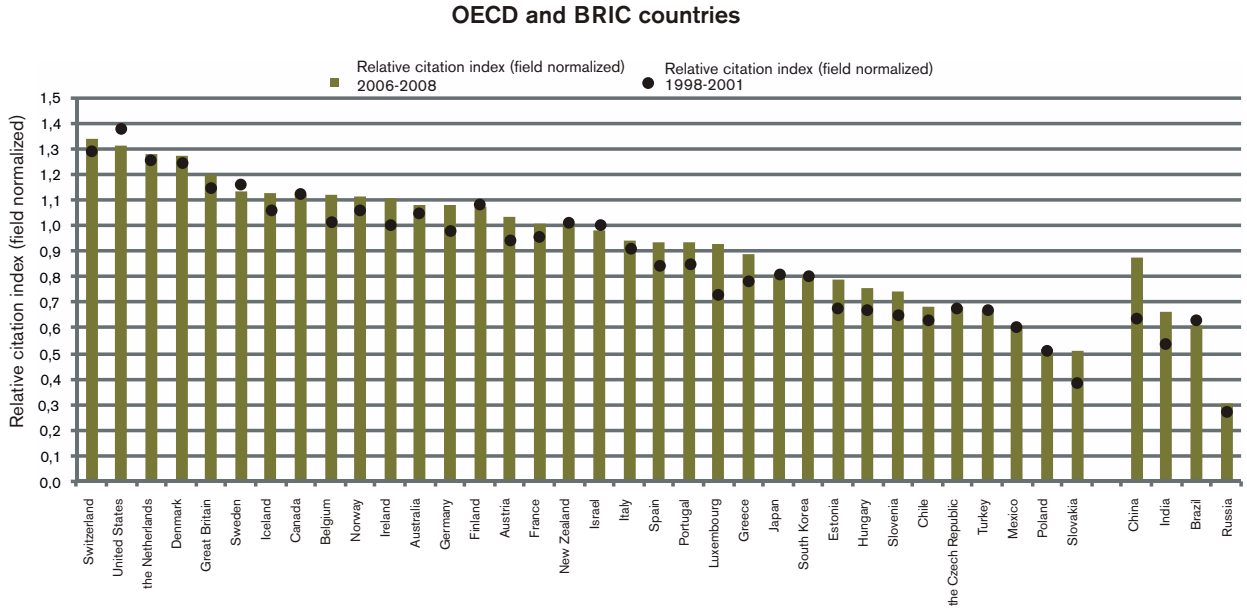


Figure 7.2 Field normalized citation index for OECD and BRIC countries between the years 1998-2001 and 2006–2009

Swiss and US publications in the years 2006-2008 received more than 30 per cent more citations than the world average (Figure 7.2). From the early 2000s, the Swiss publications' relative citation index has increased, while the citation rate received by US publications relative to world average has decreased. Among the 34 OECD countries, Finland ranked in 14th position for the years 2006–2008, while its rank for the years 1998-2001 was eighth.

The relative citation index for most of the OECD countries increased during the period under study. Finland together with eight other OECD countries, however, displayed an opposite trend, although the decrease in the citation indices was minor. Of the OECD countries that were above the world average, Belgium and Ireland achieved the greatest growth in their relative citation indices. China has shown quite an increase in relative citation index from the early 2000s, although it still remains below the world average.

The range between the minimum and maximum of OECD countries' relative citation index diminished between 1990 and 2008 (Table 7.1). The weakest countries performed relatively better than previously and, accordingly, the most influential countries receive proportionately fewer citations. The number of OECD countries that were above the world average has also increased during the past two decades.

Table 7.1 Field normalized citation index for OECD and BRIC countries in the years 1990-2008. Citation rates equal to or greater than the world average (1.00) are in bold

OECD countries	1990-1993	1994-1997	1998-2001	2002-2005	2006-2009
1. Switzerland	**1,24**	**1,30**	**1,29**	**1,30**	**1,34**
2. United States	**1,42**	**1,39**	**1,38**	**1,34**	**1,31**
3. the Netherlands	**1,22**	**1,25**	**1,25**	**1,26**	**1,28**
4. Denmark	**1,19**	**1,17**	**1,24**	**1,25**	**1,27**
5. Great Britain	**1,11**	**1,12**	**1,15**	**1,17**	**1,20**
6. Sweden	**1,18**	**1,15**	**1,16**	**1,13**	**1,13**
7. Iceland	**1,08**	**1,08**	**1,05**	**1,10**	**1,13**
8. Canada	**1,12**	**1,13**	**1,13**	**1,10**	**1,12**
9. Belgium	0,95	**1,00**	**1,01**	**1,08**	**1,12**
10. Norway	0,98	**1,01**	**1,06**	**1,10**	**1,11**
11. Ireland	0,92	0,91	**1,00**	**1,03**	**1,11**
12. Australia	**1,03**	**1,03**	**1,04**	**1,05**	**1,08**
13. Germany	0,85	0,94	0,98	**1,01**	**1,08**
14. Finland	**1,03**	**1,09**	**1,09**	**1,05**	**1,07**
15. Austria	0,82	0,94	0,94	**1,00**	**1,03**
16. France	0,89	0,94	0,95	0,98	**1,00**
17. New Zealand	0,93	**1,00**	**1,02**	0,96	**1,00**
18. Israel	0,98	**1,01**	**1,00**	0,99	0,98
19. Italy	0,82	0,87	0,92	0,93	0,94
20. Spain	0,69	0,82	0,84	0,89	0,93
21. Portugal	0,73	0,80	0,85	0,88	0,93
22. Luxembourg	0,45	0,61	0,73	0,90	0,93
23. Greece	0,63	0,71	0,78	0,84	0,89
24. Japan	0,85	0,82	0,81	0,79	0,81
25. South Korea	0,75	0,71	0,80	0,82	0,81
26. Estonia	0,48	0,66	0,67	0,71	0,79
27. Hungary	0,55	0,63	0,67	0,76	0,75
28. Slovenia	0,71	0,63	0,65	0,69	0,74
29. Chile	0,52	0,59	0,63	0,70	0,68
30. the Czech Republic	0,35	0,49	0,55	0,63	0,68
31. Turkey	0,59	0,63	0,67	0,67	0,67
32. Mexico	0,61	0,61	0,60	0,61	0,60
33. Poland	0,45	0,49	0,51	0,53	0,51
34. Slovakia	0,21	0,35	0,38	0,45	0,51
BRIC-countries	**1990-1993**	**1994-1997**	**1998-2001**	**2002-2005**	**2006-2009**
China	0,43	0,50	0,63	0,80	0,88
India	0,45	0,47	0,54	0,64	0,66
Brazil	0,56	0,61	0,63	0,66	0,61
Russia	0,18	0,24	0,27	0,30	0,30

The development of the citation impact for the six OECD countries cited most often on average is examined in more detail in Figure 7.3 and according to the different disciplines in Figure 7.4. To better compare the largest Nordic countries, we also included Finland and Norway.

Switzerland has risen in the rankings with regards to the citation impact throughout the 2000s (Figure 7.3). We witness a similar trend with the Netherlands, Denmark, Great Britain and Norway. As for US, Sweden and Finland, the citation impact began to decrease at the turn of the millennium.

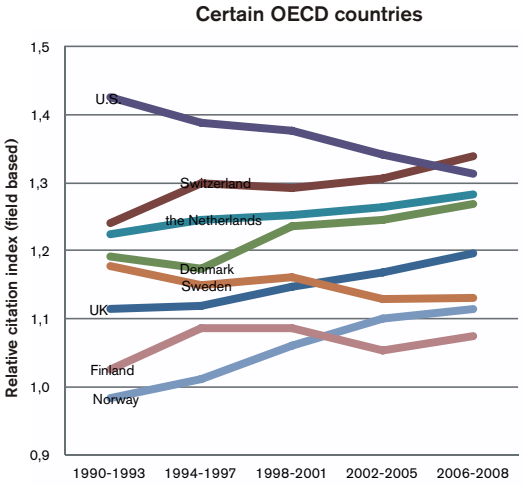


Figure 7.3 Field normalized citation index for certain OECD countries in the years 1990–2008

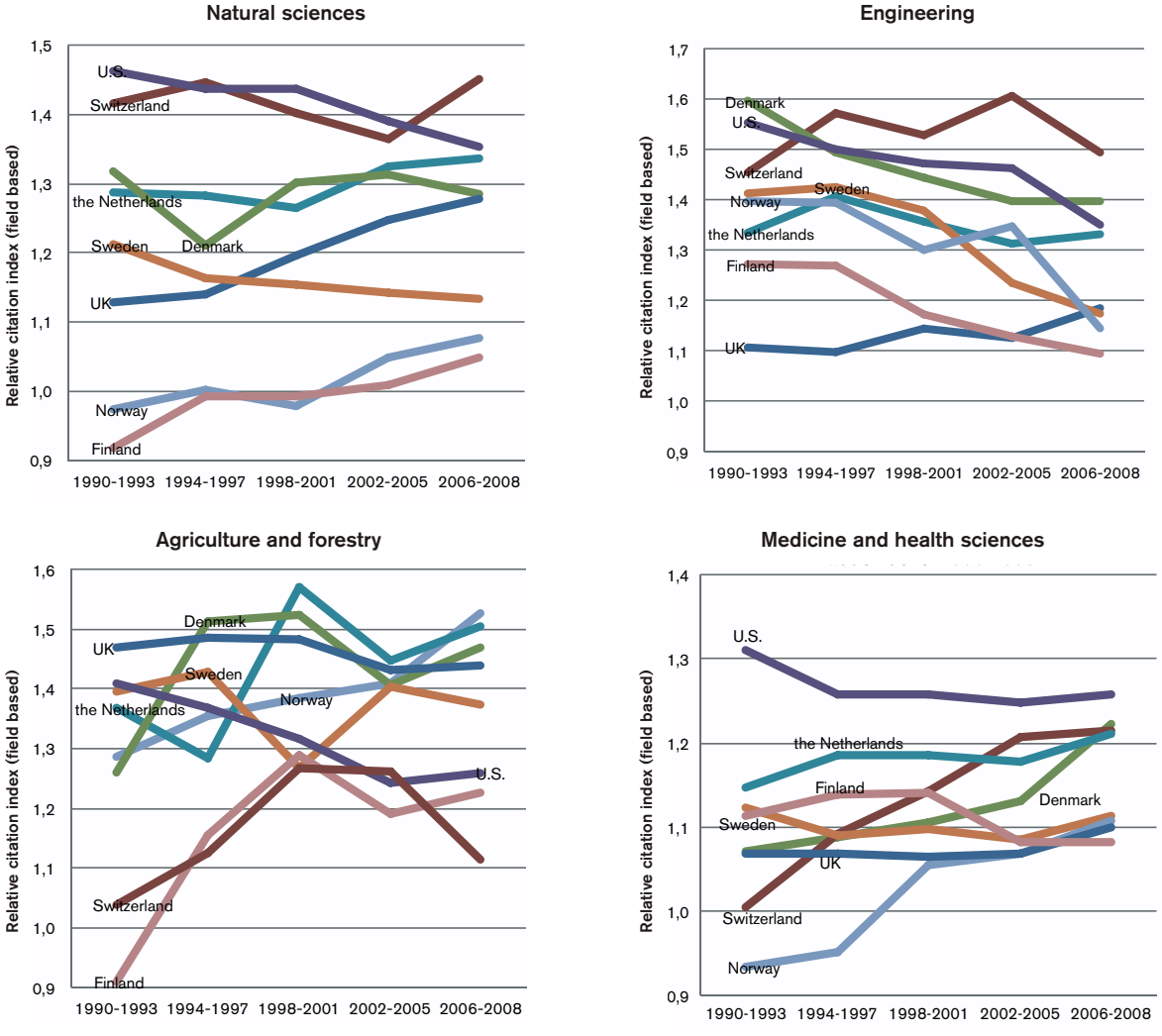


Figure 7.4 Field normalized citation index by discipline for certain OECD countries in the years 1990–2008

For the natural sciences, Switzerland and the United States have received the most citations on average throughout the whole period under study, although the order of these countries has been reversed. Great Britain has faced the most notable increase in the relative citation impact in the natural sciences. The citation index for Finnish publications has grown the second most rapidly among the eight countries under consideration.

The United States is the leading country with regards to the impact of publications in journals of medicine and the health sciences. However, Denmark, Switzerland and the Netherlands are catching up to the US in this respect. Norway has experienced a notable increase in the relative citation index in medicine and the health sciences. The Swiss index, however, has increased even more for medicine and the health sciences.

Denmark and the United States gathered more citations than other countries on average for engineering publications in the early 1990s. Switzerland has, however, strengthened its position in engineering. Like in the natural sciences, the British publications in engineering have increased the most rapidly in terms of the citation index from 1990 to 2008.

For agricultural sciences and forestry, the development of the relative citation index has differed between the countries. At the beginning of the 1990s, Great Britain had the highest relative citation index, whereas in 2006-2008 it had been overtaken by Norway, the Netherlands and Denmark. Finland, however, has shown the most notable positive change in the relative citation index. Finnish publications in agricultural sciences and forestry were cited less often than the world average in the early 1990s, but in the most recent period they received 23 per cent more citations than the world publications on average.

Appendix 1 Classification of WoS subject fields into disciplines

Natural sciences

Mathematics	Instruments & Instrumentation	Biology
Mathematics, Applied	Astronomy & Astrophysics	Biodiversity Conservation
(Mathematics, General)	Remote Sensing	Entomology
Mathematics, Interdisciplinary Applications	Nanoscience & Nanotechnology	Limnology
Statistics & Probability	Chemistry, Analytical	Marine & Freshwater Biology
Computer Science, Artificial Intelligence	Chemistry, Applied	Mycology
Computer Science, Cybernetics	Chemistry, Inorganic & Nuclear	Ornithology
Computer Science, Information Systems	Chemistry, Multidisciplinary	Ecology
Computer Science, Interdisciplinary Applications	Chemistry, Organic	Evolutionary Biology
Computer Science, Software Engineering	Chemistry, Physical	Zoology
Computer Science, Theory & Methods	Crystallography	Biochemistry & Molecular Biology
Acoustics	Electrochemistry	Biophysics
Nuclear Science & Technology	Polymer Science	Biochemical Research Methods
Optics	Geochemistry & Geophysics	Cell Biology
Physics, Applied	Geography	Microscopy
Physics, Atomic, Molecular & Chemical	Geography, Physical	Mathematical & Computational Biology
Physics, Condensed Matter	Geology	Plant Sciences
Physics, Fluids & Plasmas	Geosciences, Multidisciplinary	Microbiology
Physics, Mathematical	Meteorology & Atmospheric Sciences	Virology
Physics, Multidisciplinary	Mineralogy	Biotechnology & Applied Microbiology
Physics, Nuclear	Oceanography	Genetics & Heredity
Physics, Particles & Fields	Palaeontology	Developmental Biology
Mechanics	Water Resources	Reproductive Biology
Spectroscopy	Soil Science	
Imaging Science & Photography Technology	Environmental Sciences	

Engineering

Construction & Building Technology	Robotics	Materials Science, Paper & Wood
Engineering, Civil	Engineering, Electrical & Electronic	Materials Science, Textiles
Transportation Science & Technology	Automation & Control Systems	Engineering, Environmental
Transportation	Telecommunications	Engineering, Geological
Engineering, Aerospace	Computer Science, Hardware & Architecture	Energy & Fuels
Engineering, Industrial	Engineering, Chemical	Engineering, Petroleum
Engineering, Manufacturing	Materials Science, Ceramics	Engineering, Marine
Engineering, Mechanical	Materials Science, Characterization, Testing	Mining & Mineral Processing
Metallurgy & Metallurgical Engineering	Materials Science, Coatings & Films	Engineering, Ocean
Thermodynamics	Materials Science, Composites	Engineering, multidisciplinary
Agricultural Engineering	Materials Science, Multidisciplinary	

Medicine and health sciences

Medical Laboratory Technology	Cardiac & Cardiovascular System	Orthopaedics
Engineering, Biomedical	Respiratory System	Transplantation
Materials Science, Biomaterials	Peripheral Vascular Disease	Anaesthesiology
Cell & Tissue Engineering	Haematology	Emergency Medicine
Immunology	Geriatrics & Gerontology	Critical Care Medicine
Anatomy & Morphology	Gerontology	Radiology, Nuclear Medicine & Medical Imagi
Physiology	Rehabilitation	Dentistry, Oral Surgery & Medicine
Pathology	Medicine, General & Internal	Tropical Medicine
Medicine, Research & Experimental	Integrative & Complementary Medicine	Parasitology
Medical Informatics	Dermatology	Infectious Diseases
Neuroimaging	Allergy	Medical Ethics
Neurosciences	Oncology	Ergonomics
Toxicology	Obstetrics & Gynaecology	Substance Abuse
Pharmacology & Pharmacy	Paediatrics	Nutrition & Dietetics
Chemistry, Medicinal	Clinical Neurology	Public, Environmental & Occupational Health
Endocrinology & Metabolism	Psychiatry	Sport Sciences
Andrology	Psychology, Clinical	Nursing
Gastroenterology & Hepatology	Otorhinolaryngology	Health Care Sciences & Services
Rheumatology	Ophthalmology	Medicine, Legal
Urology & Nephrology	Surgery	

Agricultural sciences and forestry

(Agriculture, Soil Science)	Horticulture	Veterinary Sciences
Agronomy	Forestry	Agriculture, Multidisciplinary
Fisheries	Agriculture, Dairy & Animal Science	Food Science & Technology

Social sciences

Economics	Social Sciences, Biomedical	Psychology, Multidisciplinary
Social Sciences, Mathematical Methods	Women's Studies	Psychology, Psychoanalysis
Agricultural Economics & Policy	Social Work	Psychology, Social
Business	Information Science & Library Science	Behavioural Sciences
Business, Finance	Communication	Education & Educational Research
Management	Environmental Studies	Education, Scientific Disciplines
Operations Research & Management Science	Hospitality, Leisure, Sport & Tourism	Education, Special
Demography	Urban Studies	Political Science
Family Studies	Psychology	International Relations
History of Social Sciences	Psychology, Applied	Public Administration
Social Sciences, Interdisciplinary	Psychology, Biological	Planning & Development
Sociology	Psychology, Developmental	Law
Health Policy & Services	Psychology, Educational	Criminology & Penology
Industrial Relations & Labour	Psychology, Experimental	
Social Issues	Psychology, Mathematical	

Humanities

Ethics	Literature, American	Film, Radio, Television
Philosophy	Literature, British Isles	Architecture
History & Philosophy of Science	Literature, German, Dutch, Scandinavian	History
Religion	Literature, Romance	Archaeology
(Applied linguistics)	Literature, Slavic	Medieval & Renaissance Studies
Language & Linguistics	Poetry	Anthropology
Linguistics	Classics	Ethnic Studies
Literary Reviews	Theatre	Folklore
Literary Theory & Criticism	Dance	Humanities, Multidisciplinary
Literature	Music	Asian Studies
Literature, African, Australian, Canadian	Art	Area Studies

Appendix 2 Shares of publications and relative citation indices by discipline and research organization

All disciplines in total

Appendix Table 2.1 Share of Finnish publications and relative citation indices by research organization in the years 1990-2009*

Share of Finnish publications (fractionalized counts)	1990–1993	1994–1997	1998–2001	2002–2005	2006–2009	Total 1990–2009
Universities	59.5%	61.0%	57.6%	59.7%	60.5%	59.7%
State research institutes	11.6%	12.7%	12.7%	12.7%	12.8%	12.6%
University hospitals	15.8%	15.3%	15.4%	13.0%	11.7%	14.0%
Other health care units	1.8%	1.2%	1.4%	1.9%	2.1%	1.7%
Companies	4.6%	3.8%	3.8%	3.8%	3.5%	3.8%
Polytechnics	0.0%	0.1%	0.2%	0.3%	0.4%	0.2%
University of Helsinki	21.8%	20.2%	17.6%	17.3%	17.5%	18.6%
University of Turku	8.6%	9.5%	7.8%	7.2%	6.2%	7.7%
Aalto University	5.6%	6.1%	6.6%	8.5%	8.5%	7.3%
Helsinki University Central Hospital	9.1%	7.8%	7.3%	6.3%	5.5%	7.0%
University of Oulu	7.1%	7.4%	6.9%	6.4%	6.0%	6.7%
University of Eastern Finland	5.9%	6.5%	6.2%	6.2%	6.3%	6.2%
University of Jyväskylä	2.7%	3.2%	4.0%	4.2%	4.8%	3.9%
National Institute for Health and Welfare	2.7%	3.5%	3.6%	3.1%	2.9%	3.2%
University of Tampere	3.9%	2.8%	2.8%	2.7%	3.1%	3.0%
Åbo Akademi University	2.5%	2.8%	2.8%	3.1%	3.1%	2.9%
VTT Technical Research Centre of Finland	3.2%	3.0%	2.4%	2.6%	2.5%	2.7%
Kuopio University Hospital	2.3%	2.6%	2.9%	2.3%	1.7%	2.3%
Tampere University of Technology	0.6%	1.5%	1.9%	2.8%	2.9%	2.1%
Tampere University Hospital	1.4%	1.7%	2.3%	2.1%	1.9%	1.9%
Turku University Central Hospital	1.8%	2.0%	1.5%	1.2%	1.3%	1.5%
Institute of Occupational Health	1.8%	1.7%	1.5%	1.3%	1.3%	1.5%
The Finnish Forest Research Institute	0.6%	1.1%	1.3%	1.5%	1.5%	1.3%
Oulu University Hospital	1.2%	1.2%	1.4%	1.1%	1.3%	1.2%
MTT Agrifood Research Finland	1.2%	1.0%	1.1%	1.0%	1.1%	1.1%

Relative citation index (field normalized)	1990–1993	1994–1997	1998–2001	2002–2005	2006–2008	Total 1990–2008
Finland in total	1.03	1.09	1.09	1.05	1.07	1.07
Universities	1.00	1.07	1.09	1.06	1.08	1.07
State research institutes	1.09	1.13	1.13	1.09	1.12	1.11
University hospitals	1.08	1.09	1.08	1.05	1.04	1.07
Other health care units	0.82	0.98	1.05	1.03	1.09	1.01
Companies	1.00	1.12	0.92	0.94	0.91	0.97
Polytechnics	2.90	0.43	1.01	0.74	0.77	0.80
National Institute for Health and Welfare	1.24	1.33	1.45	1.33	1.35	1.35
Aalto University	1.08	1.23	1.31	1.19	1.10	1.19
University of Helsinki	1.06	1.17	1.22	1.20	1.19	1.17
VTT Technical Research Centre of Finland	1.25	1.15	1.11	1.12	1.17	1.16
Kuopio University Hospital	1.17	1.23	1.12	1.03	1.05	1.12
Helsinki University Central Hospital	1.13	1.07	1.10	1.12	1.12	1.11
Åbo Akademi University	1.06	0.98	0.95	1.19	1.13	1.07
The Finnish Forest Research Institute	1.27	1.14	1.12	0.92	1.04	1.06
University of Jyväskylä	0.80	1.08	1.11	0.98	1.13	1.04
University of Eastern Finland	0.96	1.10	1.10	0.99	1.03	1.04
University of Tampere	0.91	1.23	1.00	0.99	0.98	1.02
MTT Agrifood Research Fin-land	0.61	0.90	1.05	1.15	1.25	1.01
Tampere University Hospital	1.09	1.10	1.02	0.95	0.92	1.00
Turku University Central Hospital	0.85	0.95	1.06	1.03	1.05	0.99
Institute of Occupational Health	1.05	1.09	0.88	0.92	0.91	0.97
Oulu University Hospital	0.80	1.10	1.04	0.89	0.85	0.95
University of Turku	0.96	0.90	0.97	0.96	0.96	0.95
University of Oulu	0.95	0.94	0.89	0.90	0.97	0.92
Tampere University of Technology	0.91	0.76	0.84	0.73	0.92	0.82

*) With regard to the last period, the relative citation index only concerns publications in the years 2006–2008.

Natural sciences

Appendix Table 2.2 Natural sciences: Share of Finnish publications and relative citation indices by research organizations in the years 1990-2009*

Share of Finnish publications (fractionalized counts)	1990–1993	1994–1997	1998–2001	2002–2005	2006–2009	Total 1990–2009
Universities	76.1%	75.6%	74-9%	74.6%	74.8%	75.1%
State research institutes	13.6%	14.4%	13.2%	13.7%	13.5%	13.7%
University hospitals	2,2%	2.7%	3.3%	2.9%	2.5%	2.8%
Other health care units	0.3%	0.3%	0.2%	0.3%	0.4%	0.3%
Companies	4.9%	3.6%	3.2%	3.5%	3.1%	3.5%
Polytechnics	0.04%	0.1%	0.1%	0.2%	0.3%	0.2%
University of Helsinki	29.0%	25.3%	24.3%	22.4%	23.1%	24.3%
Aalto University	9.4%	9.4%	9.6%	11.9%	11.0%	10.4%
University of Turku	10.4%	12.4%	10.3%	9.0%	8.1%	9.8%
University of Oulu	8.7%	8.1%	8.3%	7.6%	7.5%	7.9%
University of Eastern Finland	5.2%	6.9%	7.0%	6.8%	7.2%	6.8%
University of Jyväskylä	5.3%	5.5%	6.7%	6.6%	7.1%	6.4%
Åbo Akademi University	3.3%	3.8%	4.0%	4.1%	3.9%	3.9%
VTT Technical Research Centre of Finland	4.7%	4.4%	3.2%	3.5%	3.1%	3.6%
Tampere University of Technology	0.8%	1.8%	2.4%	3.4%	3.7%	2.7%
National Institute for Health and Welfare	2.2%	2.2%	1.9%	1.7%	1.4%	1.8%
The Finnish Meteorological Institute	0.9%	1.3%	1.7%	1.7%	2.1%	1.6%
University of Tampere	3.1%	1.4%	1.4%	1.3%	1.5%	1.6%
The Finnish Forest Research Institute	0.9%	1.3%	1.4%	1.5%	1.4%	1.4%
Helsinki Institute of Physics	0.0%	0.3%	1.8%	1.8%	1.9%	1.3%
Helsinki University Central Hospital	1.1%	1.4%	1.5%	1.4%	1.2%	1.3%
Finnish Environment Institute	0.7%	0.8%	0.9%	1.2%	1.3%	1.0%

Relative citation index (field normalized)	1990–1993	1994–1997	1998–2001	2002–2005	2006–2008	Total 1990–2008
Finland in total	0.92	0.99	0.99	1.01	1.05	1.00
Universities	0.90	1.00	1.01	1.03	1.06	1.01
State research institutes	1.03	0.94	0.99	0.97	1.07	1.00
University hospitals	0.85	1.04	0.93	1.08	0.97	0.99
Other health care units	-	-	-	-	-	0.89
Companies	0.92	0.99	0.79	0.79	0.75	0.84
Polytechnics	-	-	-	-	-	0.73
Helsinki Institute of Physics	-	-	1.47	1.49	1.47	1.45
Aalto University	1.05	1.19	1.28	1.21	1.08	1.17
The Finnish Forest Research Institute	0.98	1.30	1.29	1.04	1.14	1.16
University of Helsinki	1.01	1.18	1.15	1.18	1.21	1.15
National Institute for Health and Welfare	0.84	1.00	1.26	1.12	1.51	1.14
Finnish Environment Institute	-	0.91	0.91	1.14	1.20	1.06
VTT Technical Research Centre of Finland	1.33	0.92	0.96	0.98	1.16	1.05
Helsinki University Central Hospital	0.85	1.14	0.93	1.06	1.02	1.01
University of Jyväskylä	0.75	0.99	1.03	0.92	1.20	1.00
Åbo Akademi University	0.95	0.80	0.92	1.17	1.04	0.99
University of Eastern Finland	0.68	0.90	0.92	0.92	0.98	0.90
University of Turku	0.84	0.83	0.84	0.92	0.91	0.87
The Finnish Meteorological Institute	-	0.79	0.84	0.80	0.92	0.84
University of Oulu	0.71	0.81	0.76	0.83	0.90	0.81
Tampere University of Technology	-	0.71	0.76	0.66	0.93	0.77
University of Tampere	0.63	0.86	0.75	0.84	0.71	0.75

*) With regard to the last period, the relative citation index only concerns publications in the years 2006–2008.

Organizations with a share greater than 1% in the years 1990-2009 are included. The relative citation index is displayed if the fractionalized publication count is at least 50.

Medicine and health sciences

Appendix Table 2.3 Medicine and health sciences: Share of Finnish publications and relative citation indices by research organizations in the years 1990-2009*

Share of Finnish publications (fractionalized counts)	1990–1993	1994–1997	1998–2001	2002–2005	2006–2009	Total 1990–2009
Universities	46.5%	47.3%	38.4%	38.3%	37.3%	41.3%
State research institutes	7.5%	8.9%	9.6%	9.1%	10.1%	9.1%
University hospitals	31.3%	31.1%	32.8%	31.2%	29.7%	31.2%
Other health care units	3.1%	2.1%	3.0%	4.7%	5.4%	3.7%
Companies	2.8%	2.5%	2.2%	2.1%	2.1%	2.3%
Polytechnics	0.002%	0.05%	0.2%	0.3%	0.3%	0.2%
Helsinki University Central Hospital	18.0%	15.9%	15.9%	15.3%	14.1%	15.8%
University of Helsinki	17.1%	16.1%	11.3%	11.9%	12.0%	13.5%
University of Turku	8.7%	8.4%	6.5%	6.2%	4.8%	6.8%
University of Eastern Finland	7.2%	7.2%	5.9%	6.4%	6.0%	6.5%
University of Oulu	7.3%	7.9%	6.8%	5.5%	4.7%	6.4%
National Institute for Health and Welfare	3.9%	5.5%	6.1%	5.8%	6.1%	5.6%
Kuopio University Hospital	4.6%	5.3%	5.9%	5.3%	4.4%	5.1%
University of Tampere	3.9%	4.2%	4.3%	4.1%	4.8%	4.3%
Tampere University Hospital	2.8%	3.4%	4.8%	4.8%	4.5%	4.1%
Turku University Central Hospital	3.4%	4.0%	3.1%	2.9%	3.5%	3.4%
Oulu University Hospital	2.4%	2.5%	3.0%	2.9%	3.2%	2.8%
Institute of Occupational Health	3.0%	2.7%	2.8%	2.4%	2.8%	2.7%
University of Jyväskylä	0.8%	1.2%	1.5%	1.6%	2.2%	1.5%
Aalto University	0.7%	1.0%	0.8%	1.1%	1.2%	1.0%

Relative citation index (field normalized)	1990–1993	1994–1997	1998–2001	2002–2005	2006–2008	Total 1990–2008
Finland in total	1.11	1.14	1.14	1.08	1.08	1.11
Universities	1.12	1.13	1.16	1.08	1.08	1.12
State research institutes	1.24	1.25	1.23	1.24	1.14	1.22
University hospitals	1.09	1.09	1.09	1.05	1.05	1.07
Other health care units	0.79	1.00	1.08	1.07	1.10	1.03
Companies	1.06	1.21	1.08	1.05	1.15	1.11
Polytechnics	-	-	-	-	-	-
National Institute for Health and Welfare	1.41	1.39	1.44	1.39	1.29	1.39
University of Helsinki	1.15	1.14	1.29	1.24	1.15	1.19
University of Eastern Finland	1.12	1.30	1.30	1.07	1.10	1.19
University of Jyväskylä	1.09	1.31	1.36	1.06	0.96	1.16
Kuopio University Hospital	1.19	1.27	1.12	1.03	1.04	1.13
Aalto University	-	1.61	1.18	0.88	0.83	1.12
Helsinki University Central Hospital	1.15	1.05	1.11	1.12	1.13	1.11
University of Tampere	1.00	1.22	1.07	1.01	1.04	1.07
University of Oulu	1.16	1.05	0.99	0.96	1.10	1.05
University of Turku	1.08	0.96	1.04	1.06	1.09	1.04
Tampere University Hospital	1.12	1.09	1.05	0.93	0.92	1.01
Turku University Central Hospital	0.82	0.97	1.04	1.03	1.04	0.98
Institute of Occupational Health	1.09	1.09	0.87	0.97	0.86	0.98
Oulu University Hospital	0.81	1.10	1.05	0.88	0.86	0.95

*) With regard to the last period, the relative citation index only concerns publications in the years 2006–2008.

Organizations with a share greater than 1% in the years 1990-2009 are included. The relative citation index is displayed if the fractionalized publication count is at least 50.

Engineering

Appendix Table 2.4 Engineering: Share of Finnish publications and relative citation indices by research organizations in the years 1990-2009*

Share of Finnish publications (fractionalized counts)	1990–1993	1994–1997	1998–2001	2002–2005	2006–2009	Total 1990–2009
Universities	56.0%	62.0%	62.4%	68.3%	71.3%	65.7%
State research institutes	18.1%	15.9%	13.5%	10.8%	11.0%	12.9%
University hospitals	2.1%	2.6%	2.7%	2.1%	1.9%	2.2%
Other health care units	0.0%	0.2%	0.5%	0.3%	0.4%	0.3%
Companies	16.9%	12.7%	15.5%	13.4%	10.8%	13.3%
Polytechnics	-	0.7%	0.5%	0.4%	0.6%	0.5%
Aalto University	21.8%	22.9%	23.0%	24.8%	26.2%	24.2%
VTT Technical Research Centre of Finland	15.4%	12.8%	9.7%	7.6%	7.7%	9.7%
Tampere University of Technology	3.3%	8.3%	9.7%	11.2%	11.1%	9.6%
Åbo Akademi University	8.3%	7.5%	6.7%	7.1%	6.5%	7.0%
University of Oulu	3.2%	5.7%	6.2%	7.9%	8.1%	6.8%
University of Helsinki	5.0%	6.4%	4.8%	4.5%	4.3%	4.9%
Lappeenranta University of Technology	2.5%	3.6%	4.0%	3.9%	4.9%	4.0%
University of Turku	3.1%	3.4%	2.7%	3.6%	2.3%	3.0%
University of Eastern Finland	1.1%	2.1%	2.6%	2.9%	4.1%	2.9%
University of Jyväskylä	1.1%	0.7%	1.7%	1.7%	2.4%	1.7%
University of Tampere	6.5%	1.0%	0.6%	0.4%	0.7%	1.3%
Helsinki University Central Hospital	1.1%	1.4%	1.1%	1.0%	0.7%	1.0%

Relative citation index (field normalized)	1990–1993	1994–1997	1998–2001	2002–2005	2006–2008	Total 1990–2008
Finland in total	1.28	1.27	1.17	1.13	1.09	1.17
Universities	1.30	1.25	1.24	1.13	1.15	1.19
State research institutes	1.24	1.44	1.26	1.40	1.05	1.28
University hospitals	-	-	1.14	1.07	0.94	1.20
Other health care units	-	-	-	-	-	-
Companies	1.14	1.11	0.88	0.98	0.89	0.98
Polytechnics	-	-	-	-	-	-
University of Helsinki	-	-	-	-	-	1.71
Åbo Akademi University	1.67	1.66	1.16	1.45	1.75	1.52
Helsinki University Central Hospital	1.53	2.01	1.41	1.12	0.91	1.41
VTT Technical Research Centre of Finland	1.25	1.50	1.26	1.30	0.99	1.27
Aalto University	1.21	1.28	1.40	1.15	1.13	1.22
University of Jyväskylä	-	-	-	-	1.16	1.20
University of Tampere	1.34	-	-	-	-	1.18
University of Turku	-	0.98	1.27	0.95	1.00	1.07
University of Oulu	-	1.04	1.19	1.01	0.94	1.03
University of Eastern Finland	-	-	0.94	0.99	1.19	1.01
Lappeenranta University of Technology	-	1.13	0.79	1.17	1.01	1.01
Tampere University of Technology	-	0.86	0.89	0.80	0.90	0.87

*) With regard to the last period, the relative citation index only concerns publications in the years 2006–2008.

Organizations with a share greater than 1% in the years 1990-2009 are included. The relative citation index is displayed if the fractionalized publication count is at least 50.

Agricultural sciences and forestry

Appendix Table 2.5 Agricultural sciences and forestry: Share of Finnish publications and relative citation indices by research organizations in the years 1990-2009*

Share of Finnish publications (fractionalized counts)	1990–1993	1994–1997	1998–2001	2002–2005	2006–2009	Total 1990–2009
Universities	47.2%	49.9%	48.8%	47.9%	47.0%	48.1%
State research institutes	37.3%	39.8%	40.9%	41.8%	41.1%	40.5%
University hospitals	0.7%	0.5%	0.4%	0.6%	0.5%	0.5%
Other health care units	3.4%	0.8%	0.0%	0.0%	0.1%	0.6%
Companies	6.2%	5.0%	4.6%	3.9%	5.1%	4.9%
Polytechnics	-	-	0.3%	0.3%	0.7%	0.3%
University of Helsinki	30.4%	31.1%	28.0%	26.1%	26.6%	28.0%
MTT Agrifood Research Finland	20.2%	15.3%	14.0%	13.1%	13.2%	14.6%
The Finnish Forest Research Institute	5.1%	12.0%	13.8%	16.3%	16.9%	13.7%
University of Eastern Finland	7.0%	9.5%	10.9%	10.7%	11.2%	10.2%
VTT Technical Research Centre of Finland	7.2%	5.6%	3.9%	3.8%	3.8%	4.6%
University of Turku	2.6%	3.8%	3.9%	3.0%	2.6%	3.2%
Finnish Game and Fisheries Research Institute	1.2%	1.9%	5.0%	4.0%	2.6%	3.1%
Finnish Food Safety Authority Evira	2.1%	3.2%	2.0%	2.4%	2.4%	2.4%
University of Oulu	1.4%	1.7%	2.4%	2.2%	1.8%	1.9%

Relative citation index (field normalized)	1990–1993	1994–1997	1998–2001	2002–2005	2006–2008	Total 1990–2008
Finland in total	0.91	1.16	1.30	1.20	1.23	1.18
Universities	0.93	1.24	1.45	1.31	1.25	1.26
State research institutes	0.88	1.09	1.09	1.06	1.22	1.08
University hospitals	-	-	-	-	-	-
Other health care units	-	-	-	-	-	-
Companies	-	-	-	-	1.09	1.21
Polytechnics	-	-	-	-	-	-
VTT Technical Research Centre of Finland	1.02	-	-	-	1.85	1.49
MTT Agrifood Research Finland	0.52	0.92	1.05	1.04	1.35	0.98
University of Helsinki	0.87	1.30	1.52	1.45	1.34	1.32
University of Turku	-	-	-	-	-	1.67
Finnish Food Safety Authority Evira	-	-	-	-	-	1.43
University of Eastern Finland	-	0.98	1.20	1.12	1.22	1.15
University of Oulu	-	-	-	-	-	1.01
Finnish Game and Fisheries Research Institute	-	-	0.70	-	-	0.86
The Finnish Forest Research Institute	-	1.05	0.97	0.82	0.96	0.97

*) With regard to the last period, the relative citation index only concerns publications in the years 2006–2008.

Organizations with a share greater than 1% in the years 1990-2009 are included. The relative citation index is displayed if the fractionalized publication count is at least 50.

Social sciences

Appendix Table 2.6 Social sciences: Share of Finnish publications and relative citation indices by research organizations in the years 1990-2009*

Share of Finnish publications (fractionalized counts)	1990–1993	1994–1997	1998–2001	2002–2005	2006–2009	Total 1990–2009
Universities	73.4%	72.1%	69.2%	69.4%	73.2%	71.4%
State research institutes	5.6%	7.8%	8.3%	9.0%	8.2%	8.1%
University hospitals	2.4%	6.3%	7.6%	6.5%	4.2%	5.5%
Other health care units	1.0%	1.3%	0.8%	1.3%	0.9%	1.0%
Companies	2.6%	2.5%	1.8%	1.5%	1.3%	1.7%
Polytechnics	0.0%	0.0%	0.2%	0.5%	0.9%	0.5%
University of Helsinki	24.7%	23.0%	19.1%	19.5%	18.1%	20.0%
University of Jyväskylä	6.3%	9.2%	9.4%	8.5%	9.0%	8.8%
University of Turku	6.7%	9.6%	9.8%	9.0%	8.0%	8.7%
Aalto University	7.2%	5.6%	6.7%	7.8%	9.8%	7.9%
University of Tampere	6.9%	4.7%	5.1%	8.5%	8.6%	7.1%
Åbo Akademi University	6.1%	6.9%	4.9%	4.1%	4.2%	4.9%
University of Oulu	4.2%	4.8%	4.5%	3.3%	4.2%	4.1%
University of Eastern Finland	4.9%	3.0%	3.9%	3.3%	3.7%	3.6%
National Institute for Health and Welfare	1.7%	3.7%	4.4%	3.9%	2.7%	3.3%
Hanken School of Economics	2.1%	2.4%	3.6%	2.5%	2.9%	2.8%
Institute of Occupational Health	1.4%	2.0%	1.7%	2.3%	1.2%	1.7%
University of Vaasa	3.7%	2.3%	1.4%	0.9%	1.5%	1.7%
Kuopio University Hospital	0.7%	2.2%	3.0%	1.9%	0.7%	1.6%
Helsinki University Central Hospital	1.2%	1.4%	1.9%	1.8%	1.5%	1.6%
Turku University Central Hospital	0.2%	1.9%	1.5%	1.1%	0.5%	1.0%
Lappeenranta University of Technology	0.0%	0.3%	0.2%	1.0%	2.1%	1.0%

Relative citation index (field normalized)	1990–1993	1994–1997	1998–2001	2002–2005	2006–2008	Total 1990–2008
Finland in total	0.75	0.85	0.97	0.90	0.88	0.88
Universities	0.79	0.86	0.99	0.92	0.85	0.89
State research institutes	-	1.10	1.06	0.93	1.18	1.05
University hospitals	-	0.87	1.15	0.80	1.06	0.96
Other health care units	-	-	-	-	-	0.70
Companies	-	-	-	-	-	0.77
Polytechnics	-	-	-	-	-	-
University of Tampere	-	-	1.34	1.13	0.97	1.20
National Institute for Health and Welfare	-	-	1.10	1.14	1.16	1.12
Institute of Occupational Health	-	-	-	-	-	1.11
Aalto University	0.93	0.90	1.28	1.05	0.92	1.02
Kuopio University Hospital	-	-	-	-	-	1.01
Helsinki University Central Hospital	-	-	-	-	-	0.98
Lappeenranta University of Technology	-	-	-	-	-	0.94
University of Jyväskylä	-	0.79	0.98	0.97	0.94	0.91
University of Turku	-	0.93	0.99	0.89	0.86	0.90
University of Helsinki	0.95	0.80	0.99	0.92	0.84	0.90
Turku University Central Hospital	-	-	-	-	-	0.85
University of Eastern Finland	-	-	-	-	0.64	0.82
University of Oulu	-	-	0.78	-	0.83	0.77
Hanken School of Economics	-	-	-	-	1.02	0.67
Åbo Akademi University	-	0.74	0.80	0.77	0.50	0.66
University of Vaasa	-	-	-	-	-	0.44

*) With regard to the last period, the relative citation index only concerns publications in the years 2006–2008.

Organizations with a share greater than 1% in the years 1990-2009 are included. The relative citation index is displayed if the fractionalized publication count is at least 50.

Humanities

Appendix Table 2.7 Humanities: Share of Finnish publications and relative citation indices by research organizations in the years 1990-2009*

Share of Finnish publications (fractionalized counts)	1990–1993	1994–1997	1998–2001	2002–2005	2006–2009	Total 1990–2009
Universities	89.1%	89.3%	90.0%	92.9%	87.3%	89.5%
State research institutes	0.4%	1.2%	0.5%	0.3%	0.7%	0.6%
University hospitals	0.3%	0.1%	0.4%	0.3%	0.5%	0.4%
Other health care units	-	-	-	0.1%	0.1%	0.04%
Companies	0.0%	0.1%	0.1%	0.2%	0.2%	0.1%
Polytechnics	-	-	-	0.1%	0.4%	0.1%
University of Helsinki	38.4%	44.0%	46.7%	49.2%	37.6%	42.7%
University of Turku	9.5%	16.5%	10.2%	12.4%	13.6%	12.5%
University of Tampere	12.0%	7.1%	10.2%	7.5%	8.3%	8.9%
University of Jyväskylä	4.6%	8.0%	6.5%	7.2%	8.5%	7.2%
Åbo Akademi University	11.3%	4.8%	3.2%	2.7%	4.2%	4.7%

Relative citation index (field normalized)	1990–1993	1994–1997	1998–2001	2002–2005	2006–2008	Total 1990–2008
Finland in total	0.69	1.15	1.18	1.29	1.61	1.24
Universities	0.68	1.02	1.12	1.35	1.64	1.22
State research institutes	-	-	-	-	-	-
University hospitals	-	-	-	-	-	-
Other health care units	-	-	-	-	-	-
Companies	-	-	-	-	-	-
Polytechnics	-	-	-	-	-	-
University of Jyväskylä	-	-	-	-	-	2.02
University of Helsinki	0.94	0.56	1.02	1.05	1.10	0.97
Åbo Akademi University	-	-	-	-	-	0.79
University of Tampere	-	-	-	-	-	0.76
University of Turku	-	-	-	-	0.83	0.64

*) With regard to the last period, the relative citation index only concerns publications in the years 2006–2008.

Organizations with a share greater than 1% in the years 1990-2009 are included. The relative citation index is displayed if the fractionalized publication count is at least 50.

Multidisciplinary sciences

Appendix Table 2.8 Multidisciplinary sciences: Share of Finnish publications and relative citation indices by research organizations in the years 1990-2009*

Share of Finnish publications (fractionalized counts)	1990–1993	1994–1997	1998–2001	2002–2005	2006–2009	Total 1990–2009
Universities	72.7%	76.6%	75.7%	74.1%	74.7%	74.9%
State research institutes	12.0%	10.4%	10.5%	9.8%	9.1%	10.2%
University hospitals	6.3%	6.1%	8.2%	10.9%	6.1%	7.3%
Other health care units	0.3%	1.0%	0.7%	0.7%	0.9%	0.8%
Companies	2.0%	2.9%	0.5%	1.1%	3.7%	2.2%
Polytechnics	-	-	-	0.1%	-	0.02%
University of Helsinki	32.0%	33.1%	35.9%	39.4%	41.3%	36.7%
University of Turku	9.5%	14.8%	7.0%	7.5%	9.8%	9.7%

Relative citation index (field normalized)	1990–1993	1994–1997	1998–2001	2002–2005	2006–2008	Total 1990–2008
Finland in total	1.25	2.19	1.66	1.20	1.55	1.59
Universities	1.12	1.93	1.39	0.98	1.56	1.42
State research institutes	-	-	-	-	-	3.11
University hospitals	-	-	-	-	-	-
Other health care units	-	-	-	-	-	-
Companies	-	-	-	-	-	-
Polytechnics	-	-	-	-	-	-
University of Helsinki	-	-	-	-	1.85	1.73
University of Turku	-	-	-	-	-	0.77

*) With regard to the last period, the relative citation index only concerns publications in the years 2006–2008.

Organizations with a share greater than 1% in the years 1990-2009 are included. The relative citation index is displayed if the fractionalized publication count is at least 50.

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1 Koulutus ja tutkimus vuosina 2011–2016; Kehittämissuunnitelma
2 Utbildning och forskning 2011–2016; Utvecklingsplan
3 Education and Research 2011–2016; A development plan
4 Suomen kansainvälinen yhteisjulkaiseminen
5 Tehostettua ja erityistä tukea tarvitsevien oppilaiden opetuksen kehittäminen 2007–2011; Kehittävän arvioinnin loppuraportti.
6 Lapsi- ja nuorisopolitiikan kehittämisohjelma 2012–2015
7 Barn- och ungdomspolitiskt utvecklingsprogram 2012–2015
8 Child and Youth Policy Programme 2012–2015
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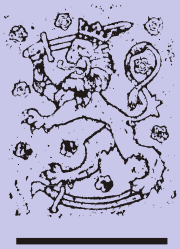

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